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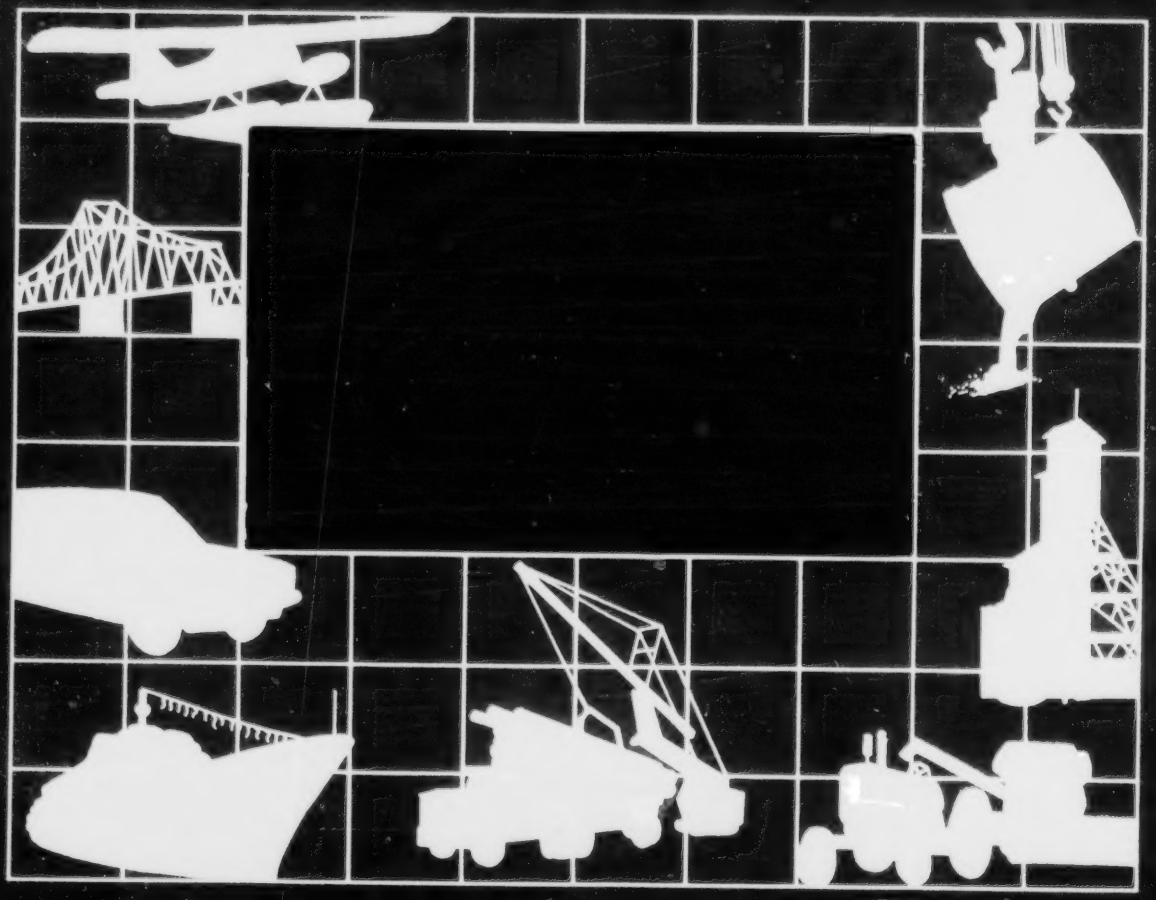

Canada

FUTURE OCCUPATIONAL REQUIREMENTS AND WORKFORCE ADJUSTMENT IN THE CANADIAN METAL MINING INDUSTRY

A Report Prepared By:

CANADIAN OCCUPATIONAL PROJECTION SYSTEM
(C.O.P.S.)

EMPLOYMENT AND IMMIGRATION CANADA

In Consultation With:

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EXECUTIVE SUMMARY

Employment in the Canadian metal mining industry has plummetted from a level of approximately 69,000 in 1981 to about 51,000 in 1985. Unlike other periods in the past when metal mining activity rebounded quickly as global economic conditions improved, Canadian metal mining production has recovered very slowly since the 1981-82 general economic recession and employment has continued to decline.

A number of factors are at work to restrain employment growth in the industry. Over the past few years a world-wide excess capacity for minerals has developed as a number of new metal producers in the less developed countries have come on the scene. Although much of the surplus has been eliminated through market forces, an overcapacity situation still exists. At the same time, mineral consumption has been growing at a reduced rate compared to traditional growth rates due to an apparent declining intensity of mineral use. These slower growth rates in consumption along with excess supply have resulted in a much more competitive market. In order to remain competitive, the Canadian industry has emphasized productivity improvement. Future growth of the industry will depend on the ability of the industry to sustain productivity gains.

This report focuses on how changes in competitive pressures in the world industry and the adoption of new technologies and production processes are affecting the Canadian metal mining workforce, and will continue to affect it over the next four or five years and perhaps longer.

Implications for the Workforce

The human resource implications of adopting new technologies and/or new production processes are not straightforward. New mining methods, the development and adoption of new drilling equipment, computer-aided mining machinery, the use of underground computer terminals, more sophisticated milling systems, and the increased use of computerization in general, have

resulted in some job displacement, but also a shift in the mix of occupations in the industry workforce.

The number of workers that can be placed in the more highly skilled occupations is increasing relative to the numbers in the less skilled occupations. The move from more manual to more mechanized operations has resulted in a proportional reduction in the mining occupations, (miners, drilling and blasting occupations, and mining labour) but has raised the skill levels required to repair and maintain more sophisticated machinery and process control systems. The general trend toward more mechanization in both mining and milling has also resulted in the requirements for more engineering technologists and technicians.

Implications for Training

The newer technologies create a growing demand for new training to operate, maintain, and repair the new machinery and equipment. There is a trend towards a more educated and more technically skilled workforce. Training its workforce will be critical for the industry in order to maintain a competitive position in the new metal mining environment.

To date the industry is not faced with shortages for new skilled workers. The major portion of skills enhancement in the industry is taking place through retraining rather than new hires. This appears to be manageable given the current growth of the industry, but if the rate of adoption of new technologies and production processes gathers momentum and/or if there is an increase in world-wide economic activity, difficulties will be encountered in attracting the required personnel for some of the high skilled occupations. Industry and government will need to closely monitor this situation.

The training problem is made more difficult for the industry in that there is a high degree of worker mobility in and out of the metal mining sector. This high mobility factor along with increasing mechanization becomes very important as it results in a need to continually upgrade the skills of the workforce.

1. THE CANADIAN METAL MINING INDUSTRY - EMPLOYMENT OUTLOOK

1.1 Introduction

In 1979 many Canadian metal mining companies were experiencing difficulties in hiring skilled workers. These difficulties raised concerns that serious shortages were developing, especially in the skilled trades groups, and such shortages would endanger the growth of industry production levels. In order to address some of the critical problems related to the attraction, training, and retention of skilled workers, occupations which could be in short supply needed to be identified and the overall magnitude of expected shortfalls had to be estimated. In other words, occupational projections or a reliable indicator of trends in overall critical skill requirements was needed. In order to meet this need the Human Resources Committee of the Mining Association of Canada conducted a survey in early 1980 of all member companies of the Association. The survey was designed to provide the occupational and labour market data and information needed to make reliable projections of occupational requirements.

The survey results projected deficits in certain skilled trades in 1981 and significant deficits in 1982.[1] The 1982 projected skill gap never materialized. As it turned out 1981 was the best year in terms of overall employment in the industry since 1974. But beginning in 1981 general worldwide economic activity declined dramatically, and in late 1981 metal mining output and employment fell abruptly. (Figure 1.1).

Today the metal mining industry in Canada is once more facing major challenges. During the 1970's various factors emerged that have had a major impact on today's industry. Overall, economic activity in the industrialized countries grew at a much slower rate compared to rates of growth in the previous decade. This has led to a reduced rate of growth of mineral consumption. At the same time there emerged a number of new

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1. Preliminary Report on Human Resource Planning In The Canadian Mining Industry, Mining Association of Canada, November, 1980.

metal producers in the less developed countries. Many of these producers were large scale, low cost and state owned, and in many cases they appeared to be production rather than market driven. They continued to produce and export regardless of selling price, appearing to put the acquisition of foreign exchange and social considerations ahead of commercial objectives. The oil crisis in the 1970's also played its part. Among other things it led to government regulatory changes in the United States regarding minimum gasoline mileage ratings for the vehicle fleet. This in turn led to a downsizing of automobiles in North America and to product substitutions. Materials such as plastics began to make inroads into areas of traditional metal uses.

The 1981-1983 general economic recession served to exacerbate the impact of these events and the Canadian metal mining industry has had to make and continues to make major changes in its operations in order to remain competitive on world markets. Given the changes that have occurred, the question arises as to how the metal mining workforce has changed. Although the industry has reduced employment it also has adopted new technologies and new production processes. New workforce organizational structures are being examined and have been adopted in some operations. What has been the impact of these changes on the workforce? Have there been major shifts in the occupational composition of the workforce? Have there been shifts in the nature of jobs or changes in job content? What will be the impact in the future, and what does it mean for training requirements?

In order to find answers to these very important questions, Employment and Immigration Canada through the Canadian Occupational Projection System (C.O.P.S.) and the Human Resources Committee of the Mining Association of Canada (M.A.C.) undertook a study to develop a better understanding of the changes taking place in the industry and the implication of these changes for employment trends by occupation. It was hoped that the study process itself could serve as a means of pooling knowledge about emerging employment and occupational trends and development and thereby generate some of the basic data and information that must precede planning, policy formulation, and decision-making.

There is no doubt that predicting what changes will occur to employment levels and skill levels is a very difficult task. Yet it must be done. If workers with the right skills are not available when required, the economic costs to the firm, the industry, the economy, and to individuals themselves can be substantial. It is realized that the methods and processes of forecasting must be improved. Better information systems will help. More cooperative efforts between industry and governments will also help. Better methodologies are also needed. It is with these factors in mind that the present study has been undertaken. A slightly different approach to that utilized in the 1980 exercise was adopted with a view to providing some enhancements to occupational forecasting techniques.

In the analysis that follows a brief overview of the metal mining industry that has emerged over the past 10 years is presented. The purpose of this overview is to identify the factors that have changed the industry and to identify the emerging patterns that will determine the future size and scope of the Canadian industry. The main consideration is the broad question of how large the total metal mining workforce might be in the future. Once the expected level of the workforce is examined, the analysis then turns to the proportion of the total workforce each occupation can be expected to account for in the future compared to today. This topic is considered in chapter 2. Chapter 3 examines some issues related to labour adjustment.

1.2 Industry Overview

Canada produces approximately 18 different metals. However, nine principal metals - copper, nickel, zinc, lead, iron, uranium, gold, silver, and molybdenum - account for well over 90% of the total value of production and export earnings.

1.2.1 Changes in the Number of Mining Operations

Table 1.1 shows the number of mining establishments that were operational during the 1974-1983 period. In terms of overall activity, 1974 was the peak year with 130 establishments.

The period from 1974 to 1978 was one of sluggish performance, and at the close of 1978 world markets had still not fully recovered from the 1974-1975 oil shock and ensuing period of slow growth. The combination of increased energy costs, higher unemployment, and annual growth rates in industrialized countries ranging between 2.5% and 3.5% down from around the 5% range in the 1961-1974 period resulted in declining demand growth. The effect was the closure or shutdown of several Canadian mines.

Table 1.1

TOTAL NUMBER OF
MINING ESTABLISHMENTS BY YEAR

Year	Total	Gold	Uranium	Iron	[1]Nickel, Copper, Zinc	Silver, Lead, Zinc	[2]Other Non-Ferrous
1974	130	21	3	18	55	25	8
1975	126	23	4	18	49	24	8
1976	115	19	6	18	40	25	7
1977	110	17	6	19	37	24	7
1978	107	18	7	18	37	20	7
1979	108	21	7	17	36	20	7
1980	115	27	8	15	36	22	7
1981	128	33	8	14	41	25	7
1982	126	38	8	12	39	22	7
1983	114	40	5	13	33	18	5

[1] Copper and Copper-Zinc Mines, and Nickel-Copper Mines
[2] Molybdenum Mines, and Other Metal Mines.

Source: Metal Mines 1983, Statistics Canada, Catalogue 26-223, February 1986.

Growth in the total number of establishments in the 1979-1982 period was due to increased activity in gold mines where buoyant gold prices spurred the opening of several new mines by 1982. In 1982, however, the situation for iron mines was serious and the number of establishments dropped from 18 in 1978 to 12 by 1982 reflecting the shake-out taking place in world steel production.

The period from late 1981 through to 1984 has been a very difficult period for the mining industry. With the exception of gold mines, the base metal sector has suffered severely during this period. By 1983 the number of mining establishments had dropped to 114; uranium establishments dropped from 8 in 1980 to 5, the number of iron mines from 18 in 1974 to 13 in 1983, nickel-copper, copper and copper zinc mines from a high of 55 in 1974 to 33 in 1983, silver-lead-zinc mines from 25 in 1974 to 18 in 1983, and other non-ferrous mines from 8 in 1974 to 5 in 1983. Gold mines experienced real growth, and over the 1974-1983 period experienced a net total increase of 19 mines.

In Appendix A, Table A.1 provides regional detail on the fluctuation in the number of establishments by industry and by province.

1.2.2 Changes in Metal Mining Employment

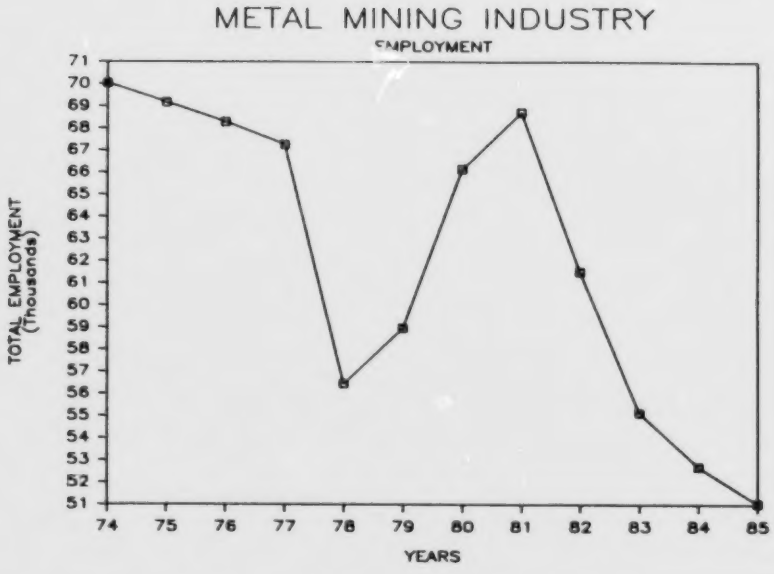
The impact on metal mining employment over the period 1974-1985 is shown in Figure 1.1. Fluctuating economic conditions have resulted in periods of strong employment growth followed by sharp employment reductions. These dramatic changes create recruitment difficulties on the upside when mining operations expand as rapidly as possible to take advantage of favourable market conditions, and labour adjustment problems on the downside when the workforce is reduced as economic conditions worsen.

Over the period 1974 to 1985 metal mining employment fluctuated between a high of just over 70,000 in 1974 to a low of 51,050 in 1985.

1.2.3 Employment By Type Of Mine

In trying to develop a clearer picture of what might happen to future employment levels in the metal mining industry, it is instructive to consider employment by type of mine and examine how employment has changed over time within each of the categories. Figure 1.2 shows these changes and Table 1.2 shows changes in the percentage of total metal mining employment for each of the categories.

Figure 1.1



Source: Annual Census of Mines.

1984: Preliminary
1985: Forecast

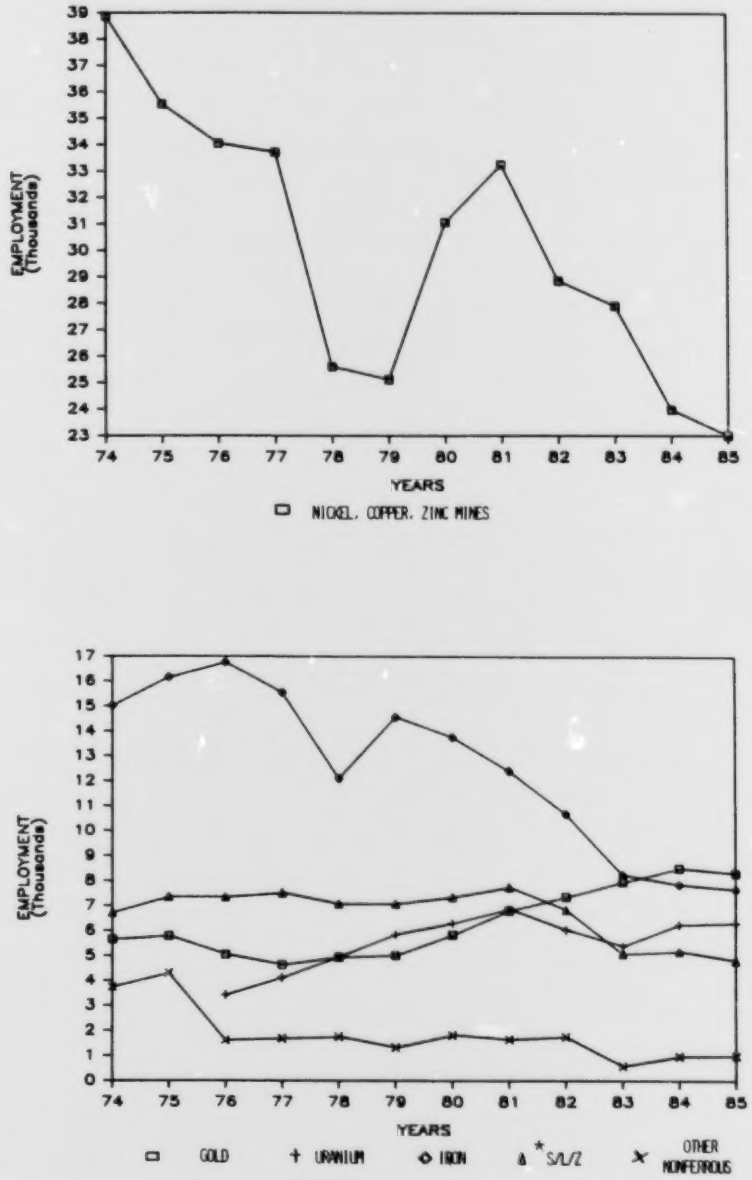
Gold mining became more of a bright spot during the latter 1970's and early 1980's. From 1974 through 1977, gold mining activity was in a slight decline and employment had dropped from about 5,700 to a low of just over 4,600 in 1977. A combination of strong upward trends in the value of gold culminated in an average selling price of over $716 Cdn. an ounce in 1980. By 1983 the number of gold mines had risen to 40 and employment had reached almost 8,000.

From Table 1.2 it can also be seen that gold mining has also become a much greater contributor to total metal mining employment, moving from about 8.0% of total mining employment in 1974 to about 16% in 1984 and 1985.

Uranium mining showed strong growth until 1981 responding to actual and anticipated increases in domestic and global demand for nuclear energy.

FIGURE 1.2

METAL MINING EMPLOYMENT BY SUB-SECTOR



*Silver, Lead, Zinc Mines

SOURCE: Metal Mines 1983, Statistics Canada, #26-223, February, 1986

Table 1.2

PERCENTAGE OF TOTAL METAL MINING EMPLOYMENT

Year	Gold	Uranium	Iron	[1]Nickel, Copper, Zinc	Silver, Lead, Zinc	[2]Other Non-Ferrous
1974	8.1%	N.A.	21.4%	55.5%	9.6%	5.4%*
1975	8.4%	N.A.	23.3%	51.4%	10.6%	6.2%*
1976	7.4%	5.0%	24.6%	49.9%	10.8%	2.4%
1977	6.9%	6.2%	23.1%	50.1%	11.2%	2.5%
1978	8.8%	8.8%	21.4%	45.4%	12.5%	3.1%
1979	8.5%	9.9%	24.7%	42.6%	12.0%	2.3%
1980	8.8%	9.5%	20.8%	47.0%	11.1%	2.7%
1981	9.9%	10.0%	18.0%	48.4%	11.3%	2.4%
1982	12.0%	9.8%	17.4%	46.9%	11.1%	2.8%
1983	15.2%	10.3%	15.8%	47.8%	9.7%	1.1%

[1] Copper and Copper-Zinc Mines, and Nickel-Copper Mines.

[2] Molybdenum Mines, and Other Metal Mines.

* Includes Uranium Mines for 1974 and 1975 only.

Although employment has been reduced slightly since 1981, it has fallen less in a relative sense to the fall in metal mining employment as a whole. Uranium mining is now contributing about 12% to total metal mining employment in 1983.

Iron ore mining employment has reflected the severe conditions that have faced the global steel industry. From a high of almost 17,000 employees at 18 mines in 1976, employment dropped to 7,650 in 1985, a 55% reduction. New production from Brazilian and Australian mines has resulted in increased competitive pressures for Canadian operations. The average grade of Canadian iron ore is significantly less than ore in other locations and requires increased processing and therefore higher selling prices to cover costs. The relative reduction in employment in Canadian iron ore mines has been much greater than in other categories of metal mines. In 1979 nearly 25% of all metal mining employment was found in iron ore mines. In 1983 through to 1985 this proportion has held at about 15%.

Nickel, copper, zinc mines comprise the largest of the mining industry sectors in terms of employment. As was previously noted, the total number of nickel-copper, copper and copper zinc mines dropped from 56 in 1974 to 33 in 1983. During the same period employment fell by about 11,000 from 38,876 to 27,901. Forecasted employment levels for 1985 show a further 4,900 reduction from the 1983 level. This indicates the difficult restructuring that the copper and nickel sub-sectors have been forced to undergo. These two sectors have seen extensive changes on world markets with reduced demand compounded by very large foreign mines coming into production.

1.3 Employment Outlook

Projecting industry employment levels over the next three to five years is not easy. But for purposes of estimating future occupational and skill requirements it is important to have some sense of how much larger or how much smaller the industry could become.

In the past, growth in the metal mining industry has been linked to the pace of overall global economic activity. This linkage is expected to continue, but various factors have come into play that have slowed the traditional growth of mineral consumption, even though world economic activity has been relatively strong over the past two years. On the demand side, there appears to be a declining intensity of mineral use. The energy crisis in the 1970's resulted in a trend towards down-sizing of products such as motor vehicles. New materials also gradually began to replace metals in different end use products such as plastics for steel in automobiles, and fibre optics for copper in long distance communication systems. Environmental regulations lowering the amount of lead content in gasoline, and the growing proportion of vehicles requiring lead-free gasoline, along with new designs in automotive batteries, have resulted in a major reduction in the potential for growth in lead consumption.

On the supply side a considerable amount of world-wide excess capacity had been built up over the past few years. Market forces have eliminated much of the surplus, as many of the more inefficient mining operations were forced to close, but it is expected that an overcapacity situation will persist for most base metals over the next three or four years.

As a result of a slower growth rate in consumption and excess supply, prices for most minerals have remained weak. If overall economic activity remains strong, excess capacity will gradually disappear and prices will begin to firm up. But until this occurs very little expansion of the Canadian industry can be expected.

Another factor impacting on growth in employment in the industry is productivity growth. Canada has always been a cost-competitive supplier of metals. In order to remain competitive in a much more competitive world, the Canadian industry has emphasized improving productivity. Canadian mining operations are now much leaner than they were five years ago. Raising productivity of course means fewer jobs for a given level of output, but future growth of the industry will depend on the ability of the industry to sustain productivity gains.

Some recovery is underway in the Canadian metal mining industry. The 1985 production tonnage levels showed substantial gains over 1983 levels in most metal mining sub-sectors. Nickel production in 1985, although still substantially below average production levels of the early 1970's, was 40% higher than production in 1983. The 1985 iron ore production showed a 30% increase in tonnage over 1983 production. Copper output was 11% higher and zinc about 5% higher. Only lead and molybdenum recorded 1985 production levels below those of 1983.[2] Yet, at the same time, as mineral output increased, industry employment fell by 4,000 workers. The gains in production along with the loss in employment point out the major improvements in productivity made by the industry.

The scenario that appears most probable then is that over the next three to five years the industry will be generally faced with demand growing at slower than traditional rates and there will be continual pressure to improve productivity. Under such a scenario it is unlikely that employment levels will grow much beyond current levels. In fact, in the absence of new mines, there could be continuing reductions in employment given the necessity to improve productivity.

To provide some added support for the above scenario a brief examination of the outlook for several base metals is presented in the following sections. These outlooks are essentially based on various reports published by the Department of Energy, Mines and Resources[3] as well as on comments received from industry representatives and EMR analysts.

1.3.1 Employment Outlook - Copper

Copper prices have fallen steadily in real terms since the mid 1970's, and there is still a considerable amount of pessimism regarding any sort of strong immediate recovery in this market. A world surplus of copper mine

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2. Energy, Mines and Resources.

3. See Bibliography.

capacity still exists, although this is gradually being reduced as continuing low prices are forcing a significant number of mine closures. But such idle capacity can also be reactivated if prices were to begin to improve, and this acts as a cap upon possible price increases.

Most forecasts indicate a growth in copper consumption of less than 1.5% per year over at least the next four or five years. Given the relatively slow growth in demand and existing and potential capacity, Canadian copper mine output is not expected to increase by any considerable extent in the near future. In order to remain competitive recent productivity gains will need to continue. Given this prognosis, there are likely to be further employment reductions in this sub-sector.

1.3.2 Employment Outlook - Nickel

Most demand forecasts for nickel indicate a relatively slow demand growth over the next five years. At the same time some excess capacity still exists. Canadian nickel mining operations are among the lowest cost producers in the world, and productivity improvements over the past few years have enhanced the competitive position of Canadian operations. Even so, anticipated supply and demand conditions will not encourage much new development and production is expected to grow only slowly over the next few years.

1.3.3 Employment Outlook - Zinc

The Zinc market is also suffering from excessive productive capacity. Canada is the world's largest producer of zinc ores and concentrates. Although zinc prices were not affected as soon as copper and nickel prices, they weakened substantially in 1985. Consequently, most Canadian companies have introduced significant cost cutting measures. As almost all Canadian production is closely associated with lead, copper, or silver, pressure still remains to further improve productivity and enhance Canada's international competitive position.

Zinc is primarily used in galvanizing and for the production of products for the transportation industry. The down-sizing of motor vehicles and the substitution of other materials for zinc therefore had a negative effect on the growth of the zinc market. Galvanizing is expected to remain the dominant use for zinc, and some positive growth is indicated by the growing use of North American automotive makers of new electrolytic galvanizing-produced steel in the body skins of some of their cars and trucks beginning in the 1987 model year. Although zinc consumption is projected to grow at lower than historical growth rates, some growth in production is expected.

1.3.4 Employment Outlook - Lead

Lead consumption in the western world fell abruptly during the 1981-1982 recession and lead prices fell to one of their lowest levels in the post-war period. Growth in lead consumption has remained flat and projected growth is considerably lower than rates of growth achieved between 1950 and 1979. The reduction of lead additives in gasoline and the growing proportion of the vehicle fleet requiring lead free gasoline has certainly dampened consumption growth. At the same time technological developments leading to the manufacturing of lighter and longer lasting batteries for automobiles has also had a negative impact on growth rates.

Compounding the problems on the demand side are certain supply factors. A large proportion of primary lead supply is from mixed ores generally containing zinc, silver, or copper. On a world-wide basis it has been estimated that as much as 65% of primary lead supply is from mixed ores. In Canada 94% of primary lead production in 1983 was from mixed ores. Short-term production decisions by primary lead producers can therefore be related to the prices of co-products. The recovery of zinc consumption for example, resulted in many primary zinc/lead operations being returned to operations, and this added to the lead surplus.

As a result of these demand and supply conditions only a stagnant market at best is expected over the next four or five years.

1.3.5 Employment Outlook - Iron Ore

The grades of crude ore in Canada vary between 18%-39% iron and such ore requires beneficiation in some form before shipping. This places Canadian mines at a competitive disadvantage with mines in Brazil and Australia which have iron ore grades of between 60% and 70%. Large increases in production capacity of high grade ore in Brazil along with slow world-wide consumption growth have kept prices low, and prices are not expected to recover in the immediate future.

Given current cost structures of Canadian mines, the availability of alternative supply sources, and the slower rate of growth in consumption it is unlikely that any large production increases will occur in Canada over the next three or four years. Employment is likely to remain flat.

1.3.6 Employment Outlook - Other Metals

Canada is the western world's leading exporter of uranium, and with cancellation and delays in planned nuclear power programs a considerable amount of uncertainty has developed in regard to the uranium market. Given this uncertainty it is expected that Canadian production will remain relatively stable over the next five years.

World consumption of silver has increased over the past few years due to increasing demand for photographic film and electronic equipment. Much of Canadian production is a co-product of other minerals. Silver output, therefore, is usually determined by the production levels of the co-product metal. The international silver market is currently in an oversupply situation, and any increase in Canadian output will be the result of increased co-product production.

There was a considerable amount of exploration activity for gold in Canada in the late 1970's and early 1980's due to the rapid rise in gold prices. The total number of mines increased from 21 in 1979 to 40 in 1983 and employment increased. Prices fell beginning in 1980, but have since stabilized. It is expected that demand will remain relatively strong if

prices remain in the U.S. $300 - U.S. $350 range. If prices slip below U.S. $300 there could be some mine closures. If prices rise to over U.S. $400 and are anticipated to stay there, there will be an increase in the rate of expansion. The short-term outlook is for continued steady growth.

Although Canadian molybdenum mines are cost competitive, molybdenum prices are so low that price does not cover operating costs for most mines in the world. Demand for molybdenum relies on the production of stainless and tool steel. Demand for these products has been growing but at a slower rate than in the 1970's. On the supply side, new copper developments and expansions in Brazil and Peru which produce by-product molybdenum will result in additional supplies for an already depressed market. There has also been increased U.S. production. It is expected, therefore, that the price of molybdenum will not recover for several years. Very little expansion can be expected in Canada.

1.3.7 Employment Outlook - Conclusions

With the onset of the recession in 1981 the demand for base metals fell and considerable world-wide excess capacity, along with falling demand, resulted in reduced metal prices. Severe retrenchment in the industry occurred. Uneconomic operations were closed and continuing operations were streamlined. As a result, employment fell dramatically from a level of 68,712 in 1981 to 55,140 in 1983. Even though overall economic activity in the Western nations picked up in 1983 and western economies have shown relatively strong positive growth for the past three years,[4] base metal mining activity has been very slow to recover for the reasons indicated in the previous sections. Employment in Canadian metal mining operations has continued to decline since 1983.[5]

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4. Growth rates for 1983, 1984, and 1985 for E.E.C. countries have been 0.8%, 2.9%, and 2.7%. The U.S. rates have been 3.7%, 6.8%, and 2.5%, while Japan has had rates of 3.6%, 10.9%, and 5.9%.

5. See section 1.2.2.

Most forecasters are indicating that world economic activity will grow from between 2.5% to 3.0% per year over the next three to four years. With this rate of growth it is not expected that excess capacity for most base metals will disappear very quickly and only steady, but certainly not strong mineral consumption growth is expected. Under this scenario, and given that Canadian companies are continuing to improve productivity, the employment level in the Canadian metal mining industry is expected to remain relatively stable.

It should be noted that this scenario is based on relatively modest growth in Canada's export markets, and as noted previously it is always difficult to forecast market trends. If overall economic growth increases to over 3% per year, excess capacity will be worked off at a much faster rate and prices for most metals may begin to firm up. If this occurs, the Canadian industry could be in a good position to take advantage of these more favourable conditions and there would be much greater potential for employment growth.

In summary, the employment level is likely to remain relatively flat over the next three or four years. However, conditions in the industry should be monitored very closely, for if market conditions improve more rapidly than anticipated, employment growth in the industry could raise some serious human resource issues for the industry. This potential problem is considered in chapter 2.

2. THE CHANGING METAL MINING WORKFORCE

2.1 Introduction

In the previous chapter the broad question of how large the total metal mining workforce might be in the future was considered. The analysis that follows in this chapter is directed towards the proportion of the total workforce that each occupation can be expected to account for in the future as compared to today. The results of both of these analyses should enable us to develop a better understanding of employment trends by occupation in the industry and therefore provide information necessary to estimate future training requirements.

In order to develop a profile of the current workforce by occupation and to determine anticipated changes in the profile, the Canadian Occupational Projection System (C.O.P.S.) in cooperation with the Human Resources Committee of the Mining Association of Canada (M.A.C.) conducted a survey of all operating metal mining companies in Canada. The questionnaire design was led by C.O.P.S. and included the advice of the Human Resources and Productivity Committee of the M.A.C. Each draft was tested with members of the Committee for relevance and accuracy. Separate survey forms were developed for mining company head offices and for individual mining operations.

An initial list of metal mining occupations was developed from the Canadian Classification and Dictionary of Occupations. A review of the United Steel Workers job description manuals updated this initial list, and then with the assistance of the Human Resources and Productivity Committee of the M.A.C. a complete list of metal mining occupations was developed which described the major hourly and salaried jobs in the industry. The industry was asked through the questionnaire to describe their workforce in terms of these occupations.

The questionnaires were mailed during late January and early February of 1985. Returns were obtained from 22 head offices and 60 mining operations. The respondent firms reported a total of 35,890 employees. This represents about 70% of total metal mining employment in 1984.

2.2 The Changing Occupational Profile

As indicated in chapter 1, the current market outlook indicates that metal mining employment will likely remain relatively flat over the next two or three years, at least. The COPS/MAC survey results also confirmed this. It should be noted, however, that the uncertainties involved in making long term forecasts are such that at the time of the survey, industry officials were unwilling to project more than two years into the future. But these projections show no growth in employment in the industry through to 1986.

A stable employment level, however, does not mean that occupational and/or skill shortages will not occur, or that training requirements will not change. The continual search for ways of increasing productivity and of reducing costs, in order to remain competitive, usually results in a changing occupational structure and in changing skill requirements. As new technology and new production methods are introduced it is more than likely that training requirements will need to increase. Indeed, because new technologies can be rapidly adopted everywhere on a world-wide basis, the more highly skilled and better trained workforce becomes a major factor in providing a competitive edge.

In order to clarify the broad occupational employment trends in the workforce, the various metal mining occupations were grouped into broad occupational categories. These are shown in Table 2.1.

Survey results were used to develop the current occupational profile for the industry. This profile was then compared to the occupational profiles developed from both the 1971 and the 1981 Census. Such a comparison serves to point out changes in the occupational structure that have occurred since 1971 and to provide some assistance in identifying developing trends.[1]

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1. It should be pointed out that the Census results and the COPS/MAC survey results are not directly comparable. The Census results are based on responses of individual households while the survey results are based on responses from individual establishments. Survey results are also based on a sample. Nevertheless, if used judiciously the comparisons can provide some useful insights in identifying trends in the changes in occupational structure.

Table 2.1

METAL MINING INDUSTRY OCCUPATIONS

Category	Main Occupations
Administrative and Professional	
Management Occupations	Mine Management, Production Management, Personnel Management, General Managers
Occupations Related to Management and Administration	Financial Officers, Personnel Officers, Purchasing Officers
Occupations in Physical Sciences	Geologists, Physical Science Technologists and Technicians, Chemists
Engineers	Mining Engineers, Industrial Engineers, Mechanical Engineers, Civil Engineers
Other Engineering Occupations	Surveyors, Engineering Technologists and Technicians, Draughtsmen
Other Professional Occupations	Systems Analysts
Clerical Occupations	Secretaries, Typists, Clerks, EDP Equipment Operators
Production Workers	
Mining Occupations	Drilling and Blasting Occupations, Miners
Milling Occupations	Occupations concerned with operating and tending equipment that reduces ores by crushing etc., and ore treatment occupations
Machining and Related Occupations	Machinists, Welders, Forging Occupations
Electrical Occupations	Electricians, and Electrical Equipment Repairing
Mechanics and Repairers	Mechanics, Precision Instrument Repairers
Other	Carpenters, Pipefitters and Plumbers, Truck Drivers, Hoisting Occupations; Motormen, material handling.

2.2.1 Trends In Occupational Structure - Managerial, Admininstrative, And Professional Occupations

Table 2.2 shows the Management, Administrative, and Professional occupations as a proportion of the total metal mining workforce as reported by both the 1971 and the 1981 Censuses, and as reported by the COPS/MAC survey. The estimate for 1984 and the projections for 1985 and 1986 obtained from the survey, showed very little variation and thus only the 1985 projections are shown.

Table 2.2

MANAGEMENT, ADMINISTRATIVE, AND PROFESSIONAL OCCUPATIONS AS A PERCENTAGE OF THE TOTAL METAL MINING WORKFORCE

OCCUPATIONAL CATEGORY	CENSUS 1971	CENSUS 1981	SURVEY 1985
Management	0.9%	2.1%	2.0%
Management Related	1.6%	1.8%	1.8%
Occupations in Physical Sciences	3.1%	2.6%	3.0%
Engineers	2.7%	2.8%	3.8%
Other Engineering Occupations	2.3%	2.5%	3.0%
Other Professional Occupations	1.1%	1.6%	1.5%
Clerical Occupations	6.3%	7.7%	7.7%
TOTAL	18.0%	21.1%	22.8%

Source: Special Tabulation 1981 Census, Statistics Canada and COPS/MAC Survey, 1985.

A number of factors are to be noted regarding these results. There was a large increase in the management category between 1971 and 1981 but this appears to have levelled off. All other occupational categories indicate no discernible trends with the exception of the Engineers and Engineering occupations. The survey results show a major increase in these categories as a proportion of the total workforce. Within the engineers category, the

survey results indicated that there was an increase in all types of engineers except mining engineers. This occupation remained at about the same proportion of the total workforce (1.6%) as it had in 1981.

In the engineering-related occupations category the survey results, when compared to the 1981 Census results, indicated declines in the proportion of surveyors and draughtsmen in this category, but there was a major increase in the proportion of engineering technologists and technicians employed.

Although there was an increase in the clerical workers category from 1971 to 1981, the survey shows that this upward trend has apparently stabilized. This in itself is an interesting result, for given the attention that has been directed towards office automation and its possible major job displacement effects, the survey indicates that the industry wide reductions in employment that have occurred since 1981 have not fallen more than disproportionately on this occupational category.

Overall, the Management, Administrative, and Professional group as a proportion of the total workforce continues to increase. From 1971 to 1981 the Census shows that this group increased from 18% to 21% of the workforce, with the major increases occurring in the management and clerical categories. The survey results indicate that the upward trend in this group is continuing with engineers and engineering technologists and technicians now contributing to the increase.

A more detailed breakdown of the engineering categories indicates that proportional growth has occurred principally with mechanical and metallurgical engineers. In 1981 mechanical engineers were only 0.2% of the metal mining workforce. The 1985 COPS/MAC survey results show that in 1984/85 they were 0.7% of the workforce. The same data sources show that metallurgical engineers had increased from 0.2% in 1981 to 0.4% in 1984/85. All other types of engineers as a proportion of the workforce retained their relative share of the workforce from 1981 to 1984/85.

It is the engineering technologists and technicians category where major changes have occurred. According to the 1981 Census this occupational group were 0.8% of the industry's workforce. According to the COPS/MAC survey this group is now 2.3% of the workforce.

2.2.2 Trends in Occupational Structure - Production Workers

In contrast to the increase in the proportion of the Management, Administrative, and Professional worker group, there has been a reduction in the production worker group as a proportion of the total industry workforce. Table 2.3 shows the apparent changes in the structure in this group.

The first thing that is noted in the changes that have occurred in the occupational structure of the production worker group is the dramatic decline in mining occupations as a proportion of the total workforce. The reduction in this category has been the major contributing factor in the overall reduction in the proportion of the production worker group. The reduction may not be quite as large as it appears however. Comparing the detailed statistics from the Census with the COPS/MAC survey results would seem to indicate that foremen were under-reported in the survey results. Nevertheless even if results are modified for under-reporting there still appears to be a considerable proportional decline in this category. For example, Miners and Mining Labour formed 22% of the total workforce in the 1981 Census, whereas the survey results show these occupations at 17%. The declining trend which is apparent from 1971 to 1981 when this occupational category dropped by five percentage points appears to be continuing.

In comparison, some of the other occupational categories are indicating a proportional increase. The upward trend which is evident from 1971 to 1981 in these higher skilled occupations is continuing through 1986. There was a slight increase in the Machining and Related occupations as a proportion of the workforce, although welders, the largest occupational group in this category showed very little change. The electrical trades, mainly electricians and occupations involved in electrical equipment repair also indicated very little change from 1981. The major change occurred in the

mechanics and repairers category. Within this category, Industrial Mechanics increased from about 7% of the workforce in 1971, to 10% in 1981, to 12% in 1985. Precision Instrument Repairers jumped from only 0.1% of the workforce in 1981 to 0.7% in 1985. This occupational group represents only a very small proportion of the workforce, but there appears to have been a substantial increase in this proportion. Although total employment fell by approximately 20,000 from 1981, employment in the Precision Instrument Repair occupational group actually increased. This is no doubt a reflection of the increase in the adoption of new technologies within the industry. With the search for and adoption of new technologies which appears to be gathering momentum in the industry, it is anticipated that the shift to higher skilled occupations will continue.

Table 2.3

PRODUCTION WORKERS AS A PERCENTAGE OF THE TOTAL METAL MINING WORKFORCE

OCCUPATIONAL CATEGORY	CENSUS 1971	CENSUS 1981	SURVEY 1985
Mining Occupations	40.4%	35.4%	25.2%
Milling Occupations	5.1%	5.5%	7.1%
Machining and Related Occupations	3.6%	3.9%	4.6%
Electrical Trades	3.6%	4.0%	4.2%
Mechanics and Repairers	9.1%	12.4%	15.6%
Other	13.6%	11.7%	9.6%
TOTAL*	75.4%	72.9%	66.3%

Source: Special Tabulation 1981 Census, Statistics Canada and COPS/MAC Survey, 1985.

* Some miscellaneous occupations such as janitors and security guards have not been included in these results and therefore the totals for the Management, Administrative, Professional and Clerical group and the Production Worker group does not add up to 100%.

2.3 The Educational Profile

Because of this shift in occupational structure, it is of some interest to identify the current educational profile of the metal mining workforce. A special tabulation from the 1981 Census provides one indication of the broad educational background of the workforce, at least as it stood in 1981. This educational profile is presented in Table 2.4.

Taken by itself the educational profile is not all that useful. It does show that a shift from the mining occupations to the milling and machining occupations, and the mechanics and repairers category, as well as the relative increase of engineering technologists and technicians will result in a more highly educated workforce. This is what one would expect.

As this same information will be collected in the 1986 Census, it will be of some interest to determine if this educational profile will have changed and if so in what direction. One would expect that the occupational shifts that have occurred since 1981 will result in a more highly educated workforce. At the same time, industry employment has fallen by about 19,000 workers since 1981, and it is generally the younger workers with less seniority that are laid-off. If these younger workers in general have a higher educational background than the older workers who remain, the 1986 educational profile could show a less educated workforce or at least one that shows very little change over the 1981 profile.

2.4 The Age Profile of the Metal Mining Workforce

Another factor that has an impact on occupational requirements is the age distribution of the workforce. If there are certain occupations which have a large percentage of workers who are 55 years of age or over then it can be expected that the level of retirements could soon put some added pressure on recruitment.

The workers' ages were not collected in the COPS/MAC survey, but data from the 1981 Census illustrates the age distribution as of 1981. This distribution is shown in Table 2.5. Again, given the changes that have

Table 2.4

EDUCATIONAL PROFILE
(1981)

Occupational Category	University Degree	Secondary Non-Univ.	Some Post Secondary	Trade Certif.	Grades 12-13	Grades 9-11	Less Than Grade 9
Management	54%	15%	14%	2%	7%	5%	2%
Occupations Related to Management and Administration	29%	24%	23%	2%	15%	7%	0
Physical Science Occupations	40%	22%	18%	0	8%	8%	4%
Engineers	65%	18%	11%	0	5%	2%	0
Other Occupations in Engineering	8%	45%	30%	2%	11%	4%	0
Other Professional Occupations	25%	35%	21%	0	4%	9%	5%
Clerical Occupations	3%	21%	25%	3%	28%	17%	2%
Mining Occupations	1.5%	4.9%	16.0%	5.9%	12.7%	33.0%	25.9%
Milling Occupations	0.8%	6.5%	16.7%	0.8%	20.4%	36.6%	18.2%
Machining and Related Occupations	0.0	7.3%	39.5%	17.2%	7.6%	15.3%	13.2%
Electrical Trades	0.0	19.2%	47.5%	19.4%	4.7%	6.8%	2.4%
Mechanics and Repairers	0.4%	10.1%	35.9%	14.8%	8.7%	15.7%	14.4%

Source: Special Tabulation 1981 Census, Statistics Canada.

Table 2.5

AGE PROFILE OF THE
METAL MINING WORKFORCE (1981)

OCCUPATIONAL CATEGORY	15-24 Yrs. of Age	25-54 Yrs. of Age	55 Yrs. of Age and Older
Management	0	85%	15%
Occupations Related to Management and Administration	3%	86%	11%
Physical Science Occupations	27%	67%	6%
Engineers	4%	86%	10%
Other Occupations in Engineering	38%	61%	1%
Other Professional Occupations	15%	79%	6%
Clerical Occupations	27%	67%	6%
Mining Occupations	22%	69%	9%
Milling Occupations	27%	66%	7%
Machining and Related Occupations	13%	79%	8%
Electrical Trades	20%	72%	8%
Mechanics and Repairers	18%	74%	8%

Source: Special Tabulation, 1981 Census, Statistics Canada.

occurred in the industry since 1981 this data may not be applicable to today's workforce. But once the 1986 Census data is available it will be of some interest to examine the changes in the age distribution that may have occurred over the past five years.

Overall, there does not appear to be any difficulty at this time with an aging workforce. In all production worker occupational categories, less than 10% of the workers in each category are 55 years of age or older. It would appear in fact that the metal mining workforce is a relatively young workforce.

2.5 The Occupational Implications of Technological Change

There is no doubt that the adoption of new technologies and more mechanization in both mining and milling have had major implications for the general shifts in occupational structure and skill requirements identified in the previous sections. However, it is very difficult to quantify or to become very specific as to the exact occupational or skill impact resulting from the adoption of certain types of technology. The nature and pace of technological change varies from company to company. Furthermore, technologies can change in unpredictable directions and the rate of change may vary.

Historically, technological change in the metal mining industry has been evolutionary. But with reduced market growth and increasing competitive pressures the need to increase productivity and reduce costs has appeared to have intensified the search for innovative production and milling processes. In addition, the rate of adoption of new technologies has increased. These changes have had and will continue to have major implications for the occupational composition and skill requirements of the workforce.

2.5.1 Implications for the Office Staff

The COPS/MAC survey results show that since 1981 all of Canada's major mining companies have invested, in varying degrees, in computers, word

processors, and enhanced telecommunications systems. Most companies responding did not indicate any significant future plans for additional computer acquisitions or further significant increases in office automation. The data received from the survey of head offices also indicates that additional computer related personnel were hired between 1982 and 1984, but there is no significant future plans for more new hires.

The survey results also showed that although systems analysts are a very small proportion of the total workforce (0.5% in 1981), this proportion has grown. In terms of numbers there is still approximately the same number of systems analysts employed in the industry now as compared to 1981. But given the overall reduction in employment in the industry since 1981 which has had a negative affect on most occupations, the systems analyst category is one occupational group that has not been affected by the general downsizing of overall employment.

Support staff changes related to the acquisition of word processors and computers appears to have been minimal. As indicated in section 2.2.1, Secretaries, Typists, and Clerks have maintained the same proportion of the workforce as in 1981. They have been negatively impacted as the result of general employment reductions but no more than the overall reduction in employment.

No discernible trends in job losses as a result of increased automation could be identified from the survey results. In some cases job losses were indicated but in other cases no job loss occurred. For example, one respondent indicated that computerization of accounting and the warehouse operations resulted in no staff changes. On the other hand, another respondent reported that improvements in clerical productivity through the use of computers in areas of purchasing, accounting, and material handling resulted in the eliminations of jobs and retraining.

With the adoption of computers and office automation a considerable amount of retraining has been undertaken by the industry. Many respondents pointed out that increasing computerization of operations has resulted in increasing requirements to upgrade the computer knowledge of the staff.

This is especially the case for occupations related to the engineering function.

2.5.2 Implications for Occupations in the Mining Operations

As previously indicated, looking for means of increasing productivity and reducing costs through the adoption of new production processes and new technologies has been a priority for the mining industry. New vertical crater retreat mining methods, the development of new drilling equipment, computer-aided mining machinery, and the use of underground computer terminals are being examined and adopted. In milling, more sophisticated monitoring systems and an increasing use of computerization is prevalent.

As stated in section 2.2.2, the adoption of more modern mining methods from more manual to more mechanized operations is having a major impact on the occupational structure of the industry. It is leading to a proportional reduction of miners and mining labour. At the same time the technology is raising the skill levels required to repair and maintain more sophisticated machinery and process control systems.

Newer technologies and processes to enhance ore recovery rates has increased the importance of the milling process as was noted in the COPS/-MAC survey results. This has resulted in some cases in a reduction in mill employment with the installation of new equipment. In other cases there were no changes in personnel connected with the mill but a significant amount of training for all mill personnel was required.

2.6 Summary

An examination of secondary data and the results of the COPS/MAC survey indicate that the Canadian metal mining industry appears to be restructuring toward a technologically more sophisticated industry. The general trend toward more mechanization in both mining and milling has resulted in the requirements for more engineering technologists and technicians.

The increasing use of new computerized process control results in the need for upgrading skill levels for both electricians and instrument technicians. Electronic technicians will likely gain in importance as more electronics are utilized.

The new technology is shifting the demand for traditional skills altering the composition of the workforce. The newer technologies create a growing demand for new training to handle and repair the new machinery and equipment. The ratio of skilled to unskilled workers is growing and will continue to grow. The general trend is towards reduced requirements for direct labour and more for indirect. The movement is towards a more educated and more technically skilled workforce.

Survey results indicate that the major portion of skills enhancement is taking place through retraining versus new hires. To date the industry is not faced with shortages of new skilled workers. But predicting skill requirements for a competitive market is very difficult. If the current rate of adoption of new technologies and new production processes increases, and if there is a favourable change in economic conditions, then difficulties could occur in attracting the required personnel in some occupations. This could be the case for some of the mineral processing occupations, as well as for the mechanical, electrical and electronic trades. Engineers could also pose some difficulty.

3. LABOUR MARKET ADJUSTMENT EXPERIENCES OF CANADIAN METAL MINING WORKERS

3.1 Introduction

From 1977 to 1983 employment in the Canadian metal mining industry fell by over 11,000 workers. Some of this reduction was due to mine closures and the rest as a result of a trimming of the workforce in existing operations in reaction to the deteriorating market situation and increased competition faced by the Canadian industry.

The Canadian metal mining industry has always been characterized by major output and employment swings. Given that at least 80% of Canada's metals and minerals are exported, industry output is very sensitive to changes in global economic activity. But such sudden changes in sector employment levels raise two major concerns. On the upside, the question of labour market flexibility arises, and on the downside there is the question of labour market adjustment.

As new mines open and/or as existing mines increase their level of operations, additional workers with the required qualifications must be hired quickly. In many cases, especially in the Canadian mining industry with many of its mines in relatively remote places with thin labour markets, this usually requires a willingness of workers to move from one area of the country to another. Geographic mobility is a major aspect of labour market flexibility and for the efficient operation of the Canadian labour market. Without an appropriate degree of labour mobility the overall level of Canadian economic activity and employment would be lower. Some elements of geographic labour mobility as it pertains to the Canadian metal mining industry will be examined in this chapter.

With reductions in employment, a major concern is with the degree of hardship experienced by the laid-off workers. In this downside adjustment situation the issues involve an understanding of three broad areas: the duration of unemployment before re-employment, the mobility pattern of

the displaced workers, and an estimation of income losses or gains in alternative employment situations.

In order to understand if special labour adjustment measures are required to facilitate the adjustment process, we need a better understanding of the adjustment process itself. For example, is the duration of unemployment a problem? Does the duration differ by worker characteristics, by regional labour market conditions, by skill levels of the workers? What are the next best alternative job opportunities? How great a factor is geographic mobility in the adjustment process? Is there an income loss? Does it differ by various demographic characteristics of workers? This chapter also presents some preliminary findings of an examination of the labour adjustment process of Canadian metal mining workers. This analysis is a beginning towards answering some of the questions posed above. As such it is descriptive of what has happened in the recent past. It is not prescriptive.

This labour adjustment analysis was based on a set of administrative data files that have been assembled for the purpose of labour market research. The study analyzed the employment-unemployment experiences and mobility patterns of a 10% sample of individuals who had at least one spell of employment in the Canadian Metal Mining Industry between January 1972 to December 1983.

3.2 Inter-Industry Mobility

It is common to consider the labour market within a static framework. Usually concerns are expressed about employment levels and the unemployment rate. These are 'stock' concepts. At any one point of time there is a stock of people employed and a stock or pool of people unemployed. Concern is usually expressed in terms of raising the level of the stock of the employed and reducing the pool of unemployed.

But another way of looking at the labour market is from a more dynamic perspective. To increase or reduce a stock there needs to be a flow. To

increase employment there must be an increase in the flow of workers into employment and reduction in the outflow. Similarly, to reduce unemployment there must be a reduction of the flow of workers into the unemployment pool and an increase in the flow of individuals out of the stock of unemployed. In this more dynamic view, the labour market is perceived as a 'stock and flow' process in which people move over time from one job to another, from one industry to another, or between being employed and unemployed.

Figure 3.1 depicts the 'stock and flow' process for metal mining sector workers in Canada over the period 1977-1983. The findings show a very high degree of mobility in and out of the metal mining sector. It was found that between 1972 and 1983, over 253,660 individuals worked in the metal mining industry in Canada at some time. This translates into three and one half times the peak employment level of 70,000 workers in the 1974-1975 period. Focussing on the industry's employment level between January 1977 and January 1983, it was found that about 57,650 individuals entered the industry and 69,487 workers left the industry over the same period. During this period a total of about 125,387 individuals worked in the industry.

This is more than double the labour force in 1983. Among the 57,650 individuals who entered the industry between 1977-1983, 23,850 or 41.4% were identified as new labour market entrants.[1]

Among those workers who left the industry during this period, 61,381 or 88.3% had found work in alternative industries by the end of the sample period. About 2,778 or 4% of individuals were on unemployment insurance claims at the end of the sample period while the remaining 5,238 or 7.7% of the workers left the workforce or had moved out of the country. Also included in this group are cases where information was not available.

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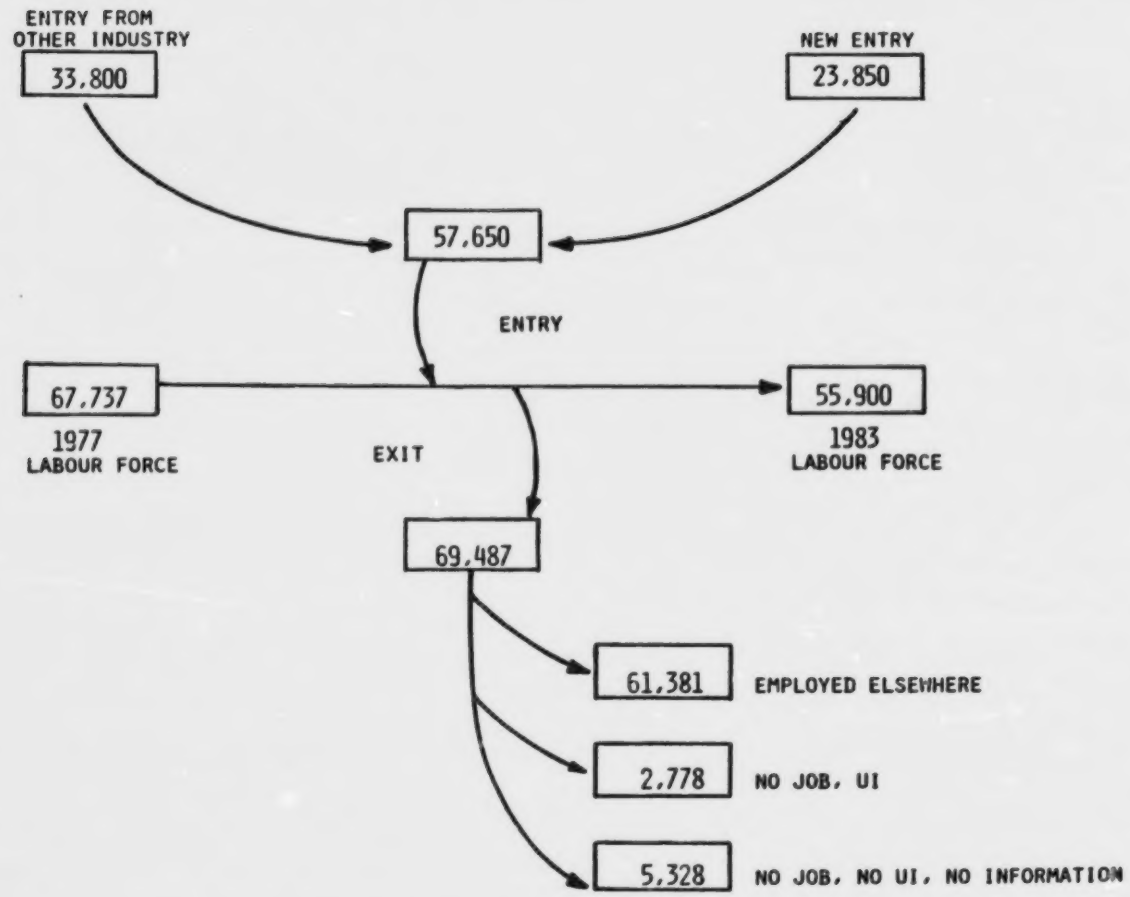
1. A new entrant was defined as an individual who had 12 weeks or less of previous work experience over the sample period.

Figure 3.1

CANADIAN METAL MINING INDUSTRY
CHANGES IN LABOUR FORCE, 1977 TO 1983*



* Employment levels are estimated from a 10% sample of the CEIC administrative data files and therefore will differ slightly from employment levels reported by Statistics Canada.

The Canadian metal mining industry is a dramatic illustration of the dynamic nature of the Canadian labour market. A very high proportion of workers 'flow through' the sector. Although average employment in the metal mining industry in 1978 was 67,737, only 39% of these individuals were still employed in the industry in 1983.[2]

One aspect of labour mobility is the movement of workers among industries and occupations in response to changes in the labour market. This movement provides some measure of response of workers to differential employment opportunities within industries. Labour mobility is a channel which corrects imbalances of demand and supply of workers. It helps mitigate human resource problems arising out of technological change, and reduces unemployment arising out of structural mismatches of workers' skills and job requirements. Inter-industry mobility, the movement of workers from one industry to another, constitutes a major source of labour market flexibility and forms an integral element in the entire adjustment process.

Focussing on inter-industry labour mobility, it is possible with the existing data to determine in which industry an individual worked prior to entering the metal mining industry. Such an analysis indicates that in 1980 the bulk of the new workers came from the service sector - over 50% of entrants in all regions. This might be expected given that the service sector accounted for about 70% of total employment in Canada in 1980.

The proportion of entrants arriving from the manufacturing sector exceeded the proportion of manufacturing employment in Quebec, the Prairies and British Columbia. In Ontario, only 17% of the entrants came from the manufacturing sector while the contribution of manufacturing sector employment to total provincial employment is about 21%. The construction

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2. To provide some perspective, 62% of the workers employed in the Auto industry in 1978 were still with the Auto industry in 1983, and 48% of the workers employed in the Electrical and Electronic industry in 1978, were still with the Electrical and Electronic industry in 1983.

sector was also a strong contributor to metal mining jobs. It played a relatively major role especially in the Atlantic provinces, the Northwest Territories, and the Yukon. More detailed findings of the industries where workers were employed prior to coming to the metal mining sector in 1980 are provided in Appendix B.

3.3 Inter-Provincial Mobility

Another aspect of labour mobility is the movement of workers from one geographic area to another. In many circumstances it is often a case of two or all three types of mobility occurring concurrently, i.e., inter-industry mobility along with geographical mobility and even occupational mobility. It is fair to expect that mobility involves simultaneous changes in regions and industries. The extent of occupational mobility depends upon the level and composition of skills among workers. Higher skilled workers and all other individuals who acquired specific training, are unlikely to change their occupations very often compared to those who are relatively unskilled. However, if specific training relates to one industry only, any decline in employment in that industry would likely result in all three types of mobility.

Regional differences in wages and unemployment rates play a significant role among other factors that influence individuals to move out of a location. A positive correlation is expected to exist between above average wage rates and the locations attracting incoming migrants. From an individual's point of view, migration often can be viewed as an investment. In the more abstract economic terms there is an optimal portfolio of investment in human capital for each location in which the potential migrant is residing. While we recognize that many non-economic factors compel individuals to migrate, we also sense that economic factors influence migration flows to a considerable extent. Although the migrant incurs substantial costs he or she may be willing to incur these costs with the expectation of an increased income flow in the future.

Mobility decisions are also related to the various socio-economic characteristics of workers. Earlier empirical studies in the U.S. indicate that the

average age of migrants is lower than the average age of non-movers.[3] This is also substantiated by a recent CEIC study.[4] On a theoretical basis, one could argue that a perspective migrant at an early age views his/her potential return from immediate migration as being greater than if migration occurs at an older age. The higher migration rate among young people may also be founded on more sociological grounds. A young person with fewer family responsibilities and lesser financial obligations can move more easily with the expectation of higher gains from migration. After a few years of employment, a number of factors would work together to reduce mobility; more job experience and better knowledge of the nature of employment, closer employer-employee/employee-employee relationships, and social security benefits associated with length of employment.[5] Similar results were found in the COPS Auto Sector Study.[6]

The geographical mobility pattern of metal mining and manufacturing sector workers is presented in Table 3.1. Between 1972 and 1983, among those individuals who worked in the metal mining sector in the Atlantic provinces, 11,370 workers moved at least once inter-provincially either to or away from their jobs in the metal mining sector. Almost six out of every ten workers (56%) moved inter-provincially. This compares to a relatively smaller number of workers (14,870 or 26%) in Quebec who had relocated. The number of individuals who either moved in or out of other regions were as follows: Ontario, 30,340 (36%); Prairies, 23,170 (67%);

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3. U.S. Bureau of the Census, Current Population Reports, Series P-20, No. 193, 'Mobility of the Population of the U.S.: March 1968 to March 1969,' U.S. Government Printing Office, Washington, D.C. 1969. (Cross reference from Wertheimer, R.F.). 'The Monetary Rewards of Migration Within the U.S.', The Urban Institute, Washington, D.C.

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Table 3.1

PROPORTION OF METAL MINING AND MANUFACTURING WORKFORCE THAT MADE AN INTER-PROVINCIAL MOVE AT SOME TIME BETWEEN THE 1972-1983 PERIOD

	Atlantic Provinces	Que.	Ont.	Prairies	B.C.	NWT/ Yukon
Number of individuals who worked in the Metal Mining Sector some time in 1972-1983	20,350	55,190	93,340	34,440	54,280	19,060
Number and proportion of metal mining workers who moved inter-provincially at least once	11,370 (56%)	14,870 (26%)	30,340 (36%)	23,170 (67%)	28,560 (53%)	16,960 (88%)
Total number of inter-provincial moves by metal mining workforce	39,300	48,940	116,620	101,260	112,010	87,450
Number of moves per mover:						
Metal Mining	3.5	3.3	3.8	4.4	3.9	5.2
Manufacturing		2.6	2.7		3.2	
Persons who worked in the manufacturing sector some time in 1972-1983 (thousands)		2,025	3,075		804	
Number and proportion of manufacturing sector workers who moved inter-provincially at least once (thousands)		306 (15%)	556 (18%)		284 (35%)	

British Columbia, 28,560 (53%); and the Northwest Territories and the Yukon, 16,960 individuals or 88%.

This group of movers was found to be extremely mobile and made an average of 3.5 inter-provincial moves each, in or out of the Atlantic region. This compares with 3.3 moves per individual in Quebec; 3.8 moves per individual in Ontario; 4.4 moves per individual in the Prairies; 3.9 moves per individual in British Columbia; and 5.2 moves per individual in or out of the Northwest Territories and the Yukon.

The level of inter-provincial mobility, ranging from 26% of all individuals who worked in the metal mining sector in Quebec to 88% in the Northwest Territories and the Yukon, is significantly different from the level of inter-provincial mobility of all those individuals who worked in the manufacturing sector as a whole. In Quebec, only 15% of 2.02 million individuals who worked in the manufacturing sector at some point between the 1972-1983 period moved inter-provincially. In Ontario and the British Columbia manufacturing sector, a somewhat higher 18% and 35% of 3.07 million and 804,000 individuals respectively, made at least one inter-provincial move. The number of moves per mover in the manufacturing sector in Quebec, Ontario, and British Columbia were lower than the metal mining averages. The places of origin and destination of those making moves are presented in Appendix C.

The origin and destination of moves vary a great deal among provinces. For example, in Quebec, 58% of incoming moves came from Ontario, whereas 19% came from both eastern and western provinces separately. In Ontario, 22% of the incoming moves came from Quebec, 59% from the western provinces, and 12% from the eastern provinces. In the Northwest Territories and the Yukon 72% of the incoming moves came from the western provinces, 18% from Ontario, while only 4% came from Quebec. Moves out of province seem to follow a similar trend in this distribution of locations. Most moves out of the Northwest Territories and the Yukon were to the western provinces, most moves out of Ontario came to the western provinces, and the majority of the moves out of Quebec landed in Ontario.

For comparison, the results from inter-provincial moves in the manufacturing sector in Ontario, Quebec, and British Columbia are also presented in Appendix B. Moves in or out of the manufacturing sector seem to follow similar patterns in this geographical distribution. Most incoming moves in Quebec came from Ontario while a majority of the outgoing moves landed in Ontario as well. Most moves out of Ontario went to the western provinces and about 50% of the incoming moves in Ontario came from the western provinces. However, moves in or out of the British Columbia manufacturing sector were mostly from the western provinces. Among the entering and exiting moves for British Columbia, other western provinces contributed 58% and 64% of these moves respectively. The evidence suggests that a large number of metal mining workers are involved in inter-provincial migration, and on a proportional basis it is much greater as compared to the manufacturing workforce as a whole.

The migration flow also gives an indication of the adjustment that is occurring continuously in the economy. A high mobility rate among workers may signal a relatively rapid adjustment process in response to certain exogeneous changes in the economy. The demographic characteristics of migrants are also important for policy purposes. For example, if mobility tends to be concentrated among young people, then any change in the demographic composition of the sectoral workforce towards an older workforce profile could result in a reduction of the degree of geographic mobility. This in turn would have a negative impact on the speed of labour market adjustment.

A closer look at exactly who migrates inter-provincially reveals, as previously indicated, that it is mainly young workers. The average age of movers was found to be below 28 years of age compared to the average age of stayers of 36 years or more. Most of those who moved inter-provincially before or after their metal mining jobs were under 30 years old - 73% in the Atlantic provinces, 68% in Quebec, 70% in Ontario, 82% in the Prairies, 66% in British Columbia, and 69% in the Yukon and the Northwest Territories (see Table 3.2). In comparison, only 10% of those over 39 years old in the Atlantic provinces, 12% in Quebec, 11% in Ontario, 6% in the Prairies, 14% in British Columbia, and 12% in the Yukon and the

Table 3.2

AGE DISTRIBUTION OF THE INTER-PROVINCIAL MOVERS AND STAYERS IN THE METAL MINING WORKFORCE IN SIX REGIONS 1972-1983

AGE GROUPS (YEARS)	ATLANTIC		QUEBEC		ONTARIO	
	MOVERS	STAYERS	MOVERS	STAYERS	MOVERS	STAYERS
< 20	16%	1%	14%	1%	15%	1%
20-29	57%	26%	54%	30%	55%	28%
30-39	18%	38%	20%	31%	18%	24%
40-49	7%	17%	8%	17%	8%	16%
50 +	3%	18%	4%	21%	3%	30%
TOTAL	100%	100%	100%	100%	100%	100%

AGE GROUPS (YEARS)	PRAIRIES		BRITISH COLUMBIA		NWT & YUKON	
	MOVERS	STAYERS	MOVERS	STAYERS	MOVERS	STAYERS
< 20	25%	2%	15%	2%	18%	10%
20-29	57%	37%	51%	32%	51%	29%
30-39	13%	27%	21%	27%	19%	17%
40-49	4%	15%	9%	15%	8%	19%
50 +	2%	19%	5%	24%	4%	24%
TOTAL	100%	100%	100%	100%	100%	100%

Northwest Territories migrated inter-provincially. On the other hand, among the stayers, the percentage of individuals who were over 39 years old was much higher - about 35% in the Atlantic, 38% in Quebec, 46% in Ontario, 34% in the Prairies, 39% in British Columbia, and 43% in the Yukon and the Northwest Territories.

Table 3.3 shows the average duration of unemployment spells for two types of workers: those workers who did not move out of their province (stayers) and those workers who migrated to seek employment in another province (movers). The average duration of unemployment for the stayers varied from 21 to 29 weeks depending upon the region. The duration of the last unemployment spell of those individuals who eventually moved to another province, on the other hand, ranged from 26 to 39 weeks. In addition, the average duration in the last unemployment spell is relatively longer than the average duration of unemployment after the move was undertaken. One interpretation of these results is that workers suffer a longer unemployment spell than average before he/she makes the decision to move out of a particular province.

3.4 Labour Adjustment Experiences

The hardship of separated workers, and the transitional costs of dislocation will largely depend on the duration of unemployment that the newly released workers will experience before becoming re-employed. The longer the duration of unemployment, the higher the costs of adjustment, other things being equal. The duration of unemployment for an individual after indefinite separation depends upon many economic, personal, and institutional factors. A lower regional unemployment rate would shorten the duration of unemployment; females and older workers may experience longer duration than prime aged male workers, and some argue that certain institutional factors such as unemployment insurance, or provincial barriers on inter-provincial mobility may prolong a period of non-employment.

Two types of workers have been identified for the purpose of this analysis: workers who permanently separated from the metal mining sector

Table 3.3

AVERAGE DURATION OF UNEMPLOYMENT IN WEEKS
OF THOSE INDIVIDUALS WHO DID NOT MOVE COMPARED
TO THOSE WHO EXPERIENCED SOME GEOGRAPHICAL MOBILITY

	Average Duration Of Those Who Did Not Move (Wks.)	Average Duration Before Moving Into Province (Last Unemployment Spell) (Wks.)	Average Duration After Moving Into Province (For Those Who Moved Into) (Wks.)
ATLANTIC	21	39	21
QUEBEC	22	36	21
ONTARIO	24	30	21
PRAIRIES	24	26	21
BRITISH COLUMBIA	21	34	18
NWT AND YUKON	29	28	21

before the end of the sample period, and workers who were still employed in the metal mining sector at the end of the sample period. These workers were, nevertheless, subject to periodic temporary lay-offs owing to cyclical down-turns in the industry.

Table 3.4 illustrates the average duration of unemployment for the metal mining sector workers and for those workers who were permanently separated. For an average worker, the average duration of unemployment in the Canadian metal mining sector was found to be 24 weeks. In other words, a worker in the mining sector as in other cyclical industries, encounters intermittent spells of unemployment over his/her working life due to temporary lay-offs arising from declines in economic activity. These intermittent spells of unemployment averaged 24 weeks.[7]

Rows (2) and (3) in Table 3.4 show the duration of unemployment spells before and after individuals were indefinitely separated from the metal mining sector. Those individuals who were permanently separated from the metal mining sector, averaged about 25 weeks per unemployment spell while still attached to the sector. However, their first unemployment spell after permanent separation from the industry averaged 28 weeks.[8]

The distribution of the duration of unemployment is also of some interest. Although the average duration of unemployment after permanent separation is 28 weeks, some individuals become re-employed very quickly while others suffer very long periods of unemployment. Table 3.5 illustrates the distribution of the duration of unemployment.

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7. This average is much higher than the duration of unemployment experienced by workers in some other Canadian sectors. In a separate study, it was found that the workers in the automotive sector had unemployment durations, on average, lasting about 9 weeks.

8. The degree of the variation in the duration of unemployment spells is not as great as was found for the automotive sector, where workers had suffered periods of unemployment of about 27 weeks after separation compared to 9 weeks before separation.

Table 3.4

DURATION OF UNEMPLOYMENT OF INDIVIDUALS WHO WERE PERMANENTLY SEPARATED FROM THE METAL MINING INDUSTRY - 1974-1983

	CAN. (Wks.)	ATL. (Wks.)	QUE. (Wks.)	ONT. (Wks.)	PRAIRIES (Wks.)	B.C. (Wks.)	NWT/YKN. (Wks.)
Average duration of unemployment per spell for all metal mining workers	24	25	23	25	22	23	23
Average duration of unemployment in the metal mining sector of those individuals who were indefinitely separated	28	26	25	26	28	23	22
Average duration of first spell of unemployment for individuals after permanent separation	28	32	31	26	28	27	26

Table 3.5

DISTRIBUTION OF UNEMPLOYMENT SPELLS
BY WEEKS OF UNEMPLOYMENT IN THE METAL MINING SECTOR

DURATION OF UNEMPLOYMENT SPELLS* (WEEKS)	CAN.	ATL.	QUE.	ONT.	PRAIRIES	B.C.	NWT/YKN.
< 4	15%	15%	14%	14%	18%	21%	19%
5-12	16%	14%	16%	13%	18%	18%	21%
13-25	30%	18%	22%	40%	22%	21%	23%
26-51	24%	32%	29%	22%	26%	24%	24%
51 +	15%	21%	19%	11%	16%	16%	13%
TOTAL	100%	100%	100%	100%	100%	100%	100%

* First Unemployment Spell After Indefinite Separation.

In summary, the average duration of unemployment after permanent separation from the metal mining industry appears to be approximately seven months. Findings from other studies shows that this is approximately what can be expected in other sectors as well. For some workers, the job loss results in only a relatively brief period of unemployment and the cost is relatively slight in terms of time unemployed. In other cases, the re-adjustment to the job loss is relatively more severe. Many factors will impact on the duration of unemployment:

- economic conditions at the time of lay off;
- the relative size of the labour market and the diversity of economic activity in the region in which the worker lives;
- the characteristics of the worker such as age, and skill level;
- the likelihood of being recalled and its impact on subsequent job search.

There is still much work to be done to determine the strength of these factors in terms of their impact on unemployment duration.

3.5 The Next Job

When unemployed workers become re-employed their next job will occur in any one of a number of different industries. Table 3.6 illustrates the sectors in which workers who were permanently separated from the metal mining sector from 1978-1983 eventually found jobs. About 56% of the new jobs were found in the service sector. Appendix D shows the breakdowns by region.

3.6 Loss in Earnings

Even when separated workers do find jobs, it is likely that they will suffer a relative loss in wages, at least initially, compared to their previous jobs in the metal mining industry. As we have seen, a large proportion of the workers found jobs in the service sector where wages are very often less than wages in the metal mining industry.

Table 3.6

DISTRIBUTION OF INDIVIDUALS BY INDUSTRIES AFTER PERMANENT SEPARATION FROM THE CANADIAN METAL MINING SECTOR

INDUSTRIES	PERCENT
Agriculture	0.97
Forestry	1.98
Fishing - Trapping	0.83
Placer Gold Mine	0.43
Food - Beverage	1.88
Tobacco Products	0.01
Rubber - Plastics	0.36
Leather Industries	0.07
Textile Industries	0.21
Knitting Mills	0.02
Clothing Industries	0.03
Wood Industries	3.19
Furniture - Fixture	0.31
Paper Industries	2.64
Printing - Publishing	0.37
Primary Metal	6.26
Metal Fabrication	1.69
Machinery Industry	1.29
Transport Equipment	0.39
Electrical Products	0.51
Non-Metal Minerals	0.85
Petroleum - Coal	0.25
Chemical Product	0.48
Miscellaneous Manufacturing	0.29
Construction	16.40
Transport - Communication	7.42
Trade	9.89
Finance-Insurance-Real Estate	7.06
Commerce-Business-Personal Service	17.95
Public Administration-Defence	9.75
Other Mines	4.81
Other Unspecified	1.32

The estimates of the gross-of-tax weekly wage rates that this group of indefinitely separated workers were earning in the job prior to their final separation from the metal mining industry is reported in row (2) of Table 3.7. The weekly wage rates that the same group of workers earned in an alternative employment situation is shown in row (3) of this Table.

The results suggest that workers experience, initially, a considerable drop in wage earnings in an alternative employment situation compared to their earnings in the metal mining sector. In the case of the Canadian sample, our findings show that an average metal mining worker who separated earned about $368.00/week in metal mining, compared to $284.00/week in their first job in the non-metal mining sector. This represents a decline in wage rates of 23%. The drop in wage rates varies among provinces and regions. The workers in Quebec experienced a 41% decline, the largest among all regions; Atlantic provinces, 31%; Ontario, 21%; Prairies, 11%; British Columbia, 9%; and the workers in the Northwest Territories and the Yukon experienced a 19% decline in wage earnings.

3.7 Summary

In summary, this chapter reports on an examination of some of the features of the adjustment experience of workers in the Canadian metal mining industry over the period from 1972 to 1983. The analysis focussed on several aspects of the workers experience, their degree of inter-industry mobility, their geographical migration experience, and with workers who permanently separated from the industry, the study focussed on the length of time they were unemployed following permanent separation, the industry in which they found employment following permanent separation, and the differences in their weekly wages in their next job as compared with their job in the metal mining industry.

Generally, the data show the following characteristics:

i) There is a very high proportion of workers who flow through the sector. This characteristic has been found in other sectors as well, although not to the same high degree as in mining.

Table 3.7

GROSS WEEKLY WAGES (1981$) WITHIN THE METAL MINING INDUSTRY AND AFTER INDEFINITE SEPARATION

	CAN. ($)	ATL. ($)	QUE. ($)	ONT. ($)	PRAIRIES ($)	B.C. ($)	NWT/YKN. ($)
Average individual in the metal mining industry	383.00	402.00	419.00	389.00	317.00	390.00	410.00

FOR INDIVIDUALS WHO SEPARATED FROM METAL MINING INDUSTRY

	CAN. ($)	ATL. ($)	QUE. ($)	ONT. ($)	PRAIRIES ($)	B.C. ($)	NWT/YKN. ($)
In metal mining industry jobs before separation	368.00	390.00	390.00	383.00	296.00	373.00	392.00
In non-metal mining industry jobs after separation	284.00	271.00	236.00	302.00	265.00	339.00	319.00

There appears to be a dynamism in the labour market which is impressive;

ii) geographic mobility is significant which is especially important for the metal mining sector;

iii) the workers leaving the sector are characterized by extensive movement to a broad array of other sectors, notably the service sector;

iv) the average duration of unemployment after separation from the metal mining industry does not differ significantly from that of workers who have permanently separated from other industries;

v) the average weekly wage in their next job is, at least initially, lower than the weekly wage they received in the metal mining industry.

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APPENDIX A

NUMBER OF ESTABLISHMENTS BY MINING SUB-SECTOR/ BY PROVINCE FOR SELECTED YEARS

TABLE A.1

NUMBER OF ESTABLISHMENTS BY MINING SUB-SECTOR/ BY PROVINCE FOR SELECTED YEARS

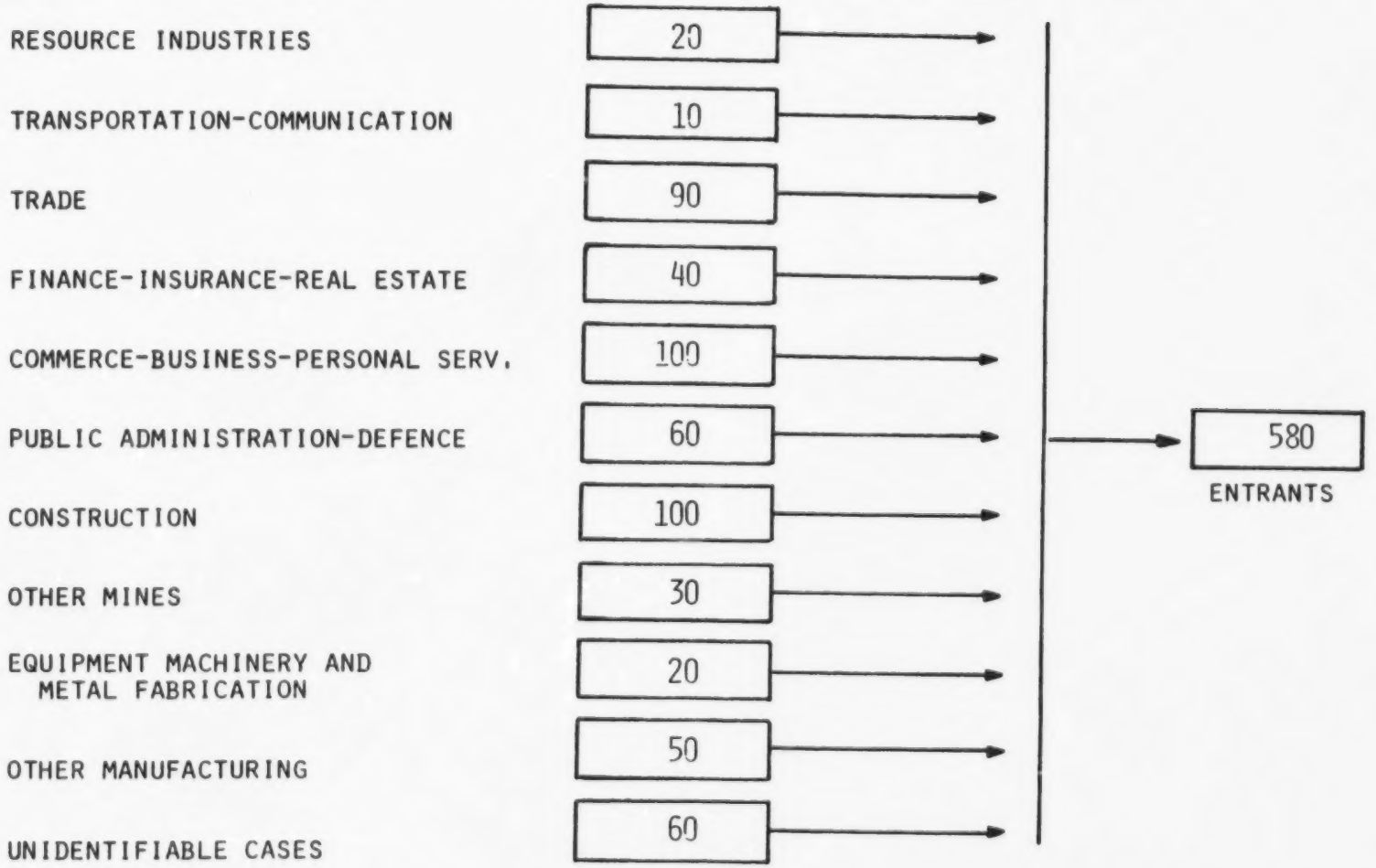
		NFLD	NB	NS	QUE	ONT	MAN	SASK	BC	YUK/ NWT	TOTAL
	1974				6	10				5	21
	1976				5	9				5	19
Gold	1978				6	7				5	18
	1980				13	8			2	4	27
	1982				14	13	1		7	4	38
	1974					2		1			3
	1976					3		3			6
Uranium	1978					4		3			7
	1980					4		3			8
	1982					4		4			8
	1974	3			5	8			2		18
	1976	3			5	8			2		18
Iron	1978	3			6	8			1		18
Ore	1980	3			6	5			1		15
	1982	3			4	4			1		12
	1974	1	1		15	11	7	1	17	2	55
Nickel,	1976	1	-		8	10	5	1	13	2	40
Copper,	1978	1			7	9	4	1	13	2	37
Zinc	1980	1			7	10	4	1	11	2	36
	1982	1			8	8	4	1	15	2	39
	1974	1	3		3	5			9	4	25
Silver,	1976	2	3		4	4			8	4	25
Lead,	1978	2	2		3	3			5	5	20
Zinc	1980	2	3	2	2	3			6	5	22
	1982	2	2		3	3			7	5	22
	1974		1		2		1		3	1	8
Other	1976		1		2		1		2	1	7
Non-	1978	1			2		1		2	1	7
Ferrous	1980		1		2		1		2	1	7
	1982				2		1		3	1	7
TOTAL											
	1974	5	5	0	31	36	8	2	31	12	130
	1976	6	4	0	29	34	6	4	25	12	115
	1978	7	2	0	24	31	5	4	21	13	107
	1980	6	3	2	30	30	5	4	22	12	114
	1982	6	2	0	31	32	6	5	33	13	128

Source: Metal Mines 1983, Statistics Canada, Catalogue 26-223, February 1986

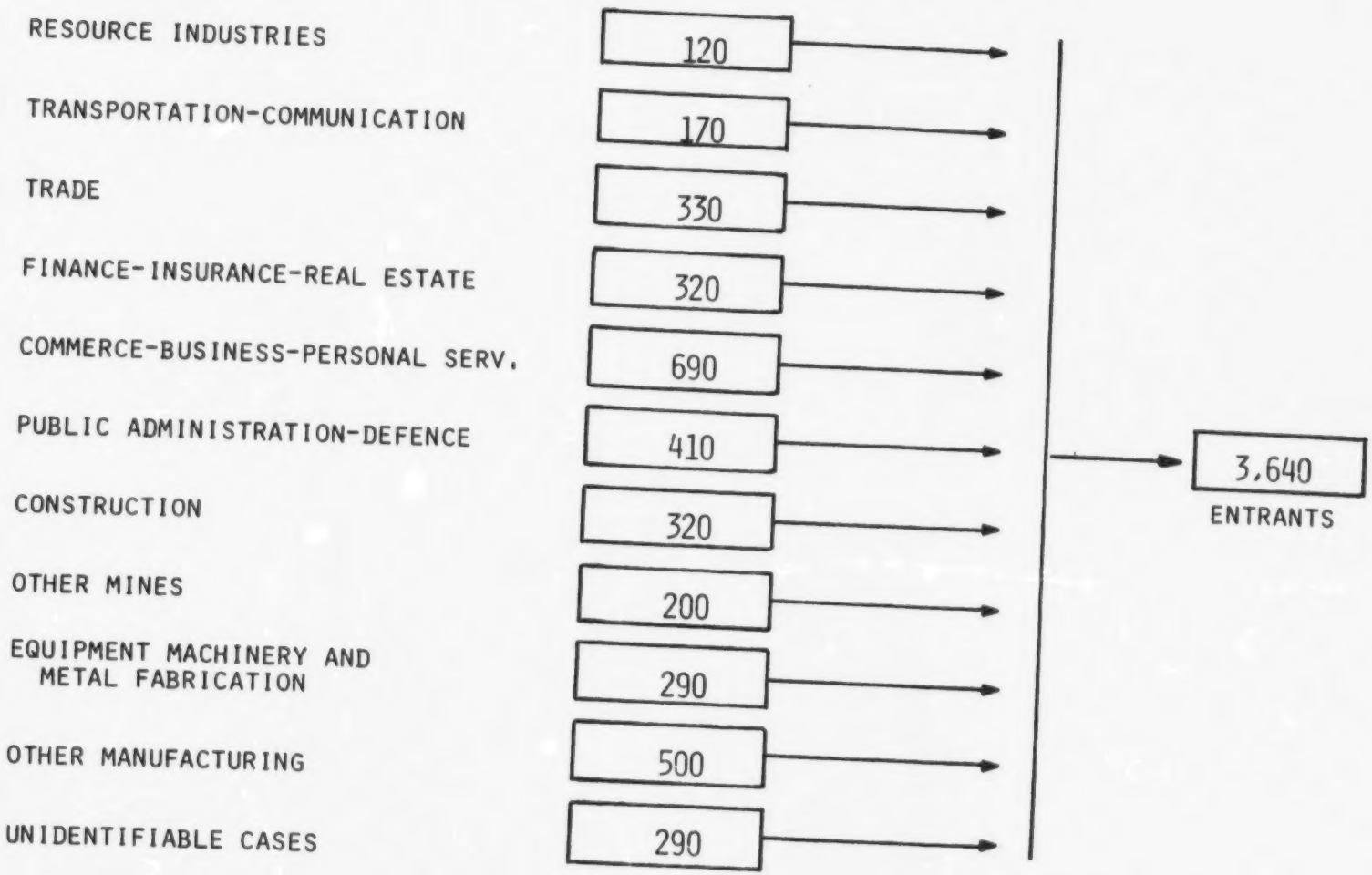
APPENDIX B

INTER-INDUSTRY MOBILITY - ENTRANTS (1980)

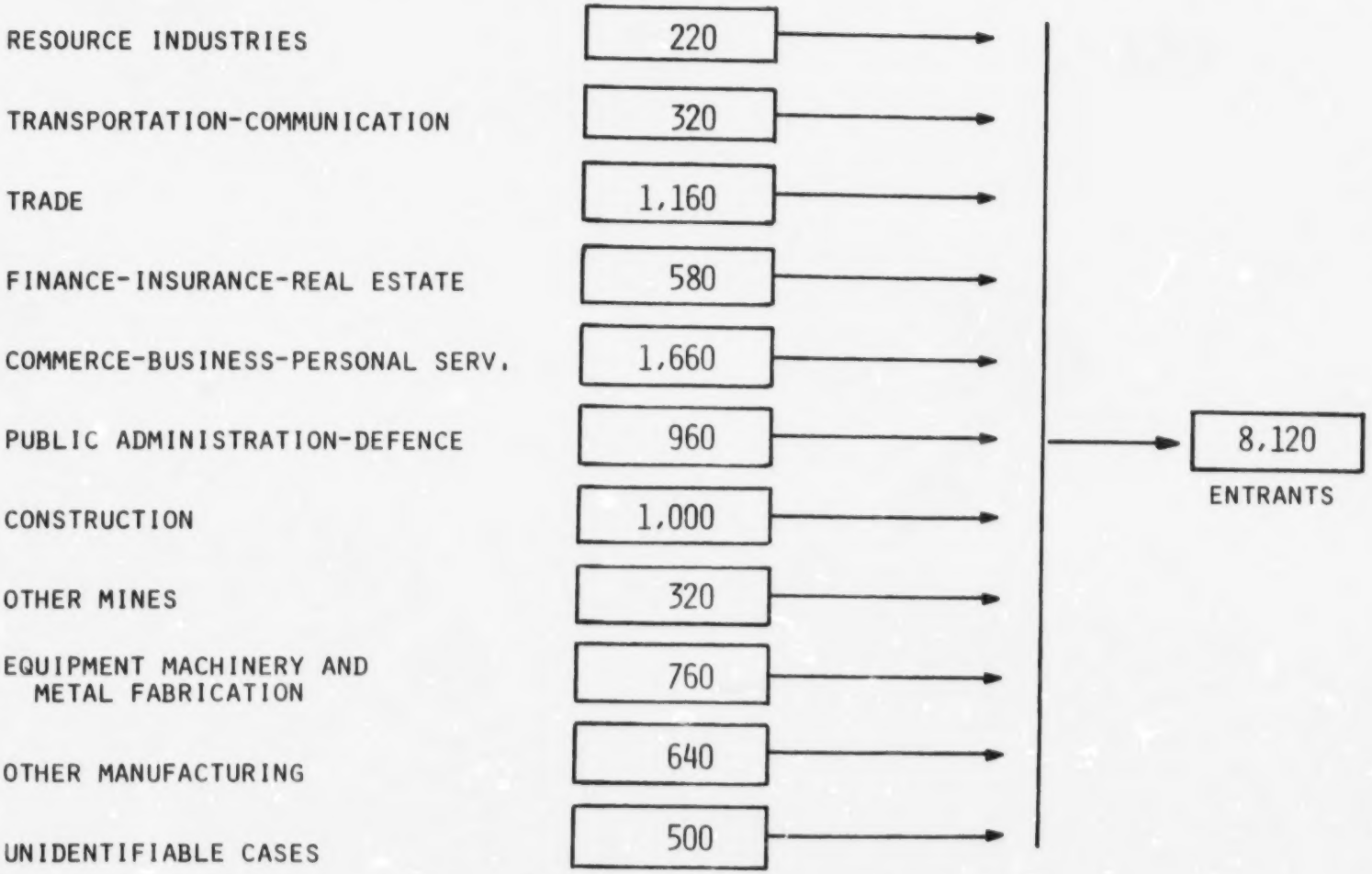
INTER-INDUSTRY MOBILITY - ENTRANTS (1980)
METAL MINING INDUSTRY (ATLANTIC)



INTER-INDUSTRY MOBILITY - ENTRANTS (1980)
METAL MINING INDUSTRY (QUEBEC)

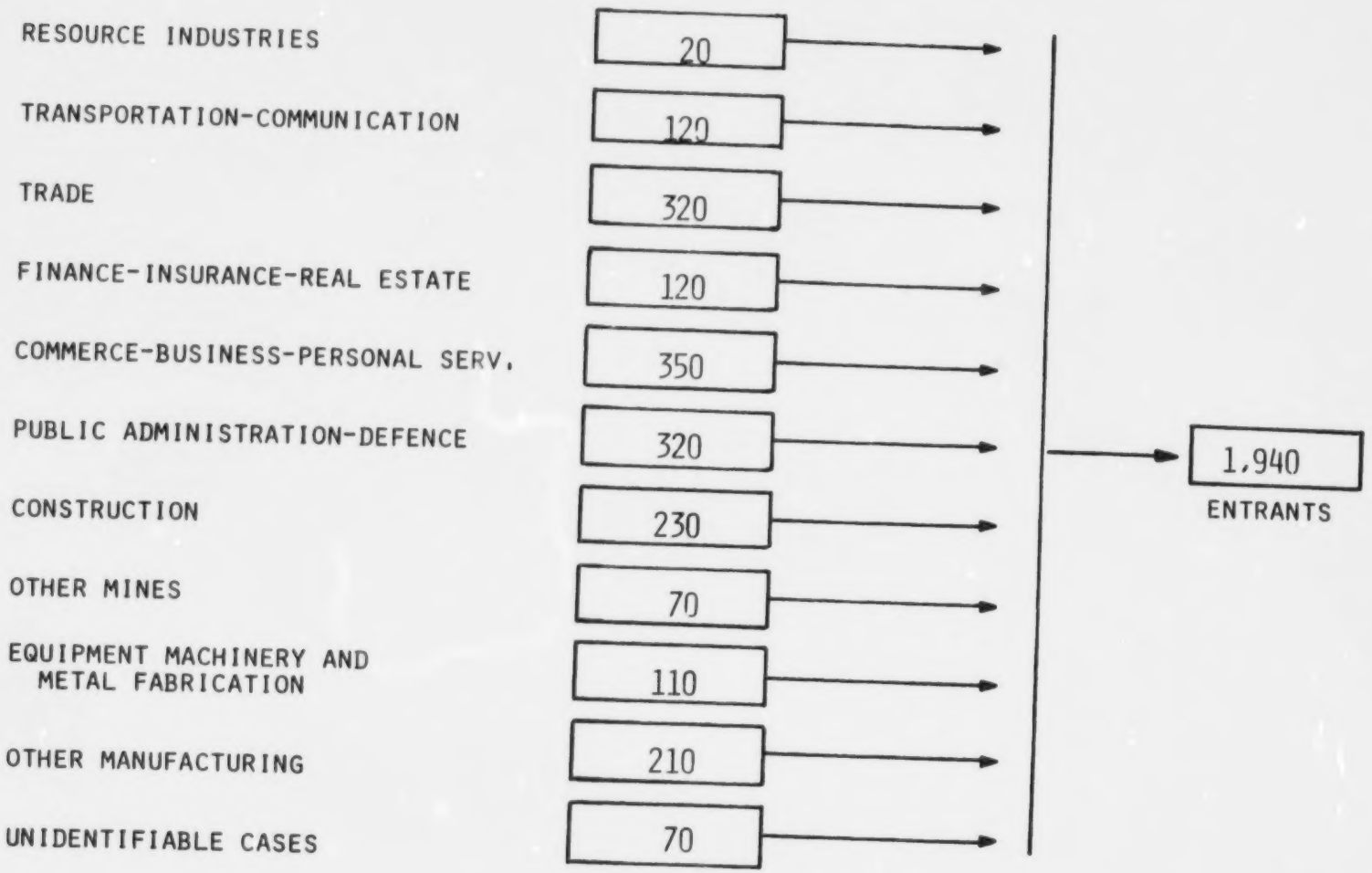


INTER-INDUSTRY MOBILITY - ENTRANTS (1980)
METAL MINING INDUSTRY (ONTARIO)

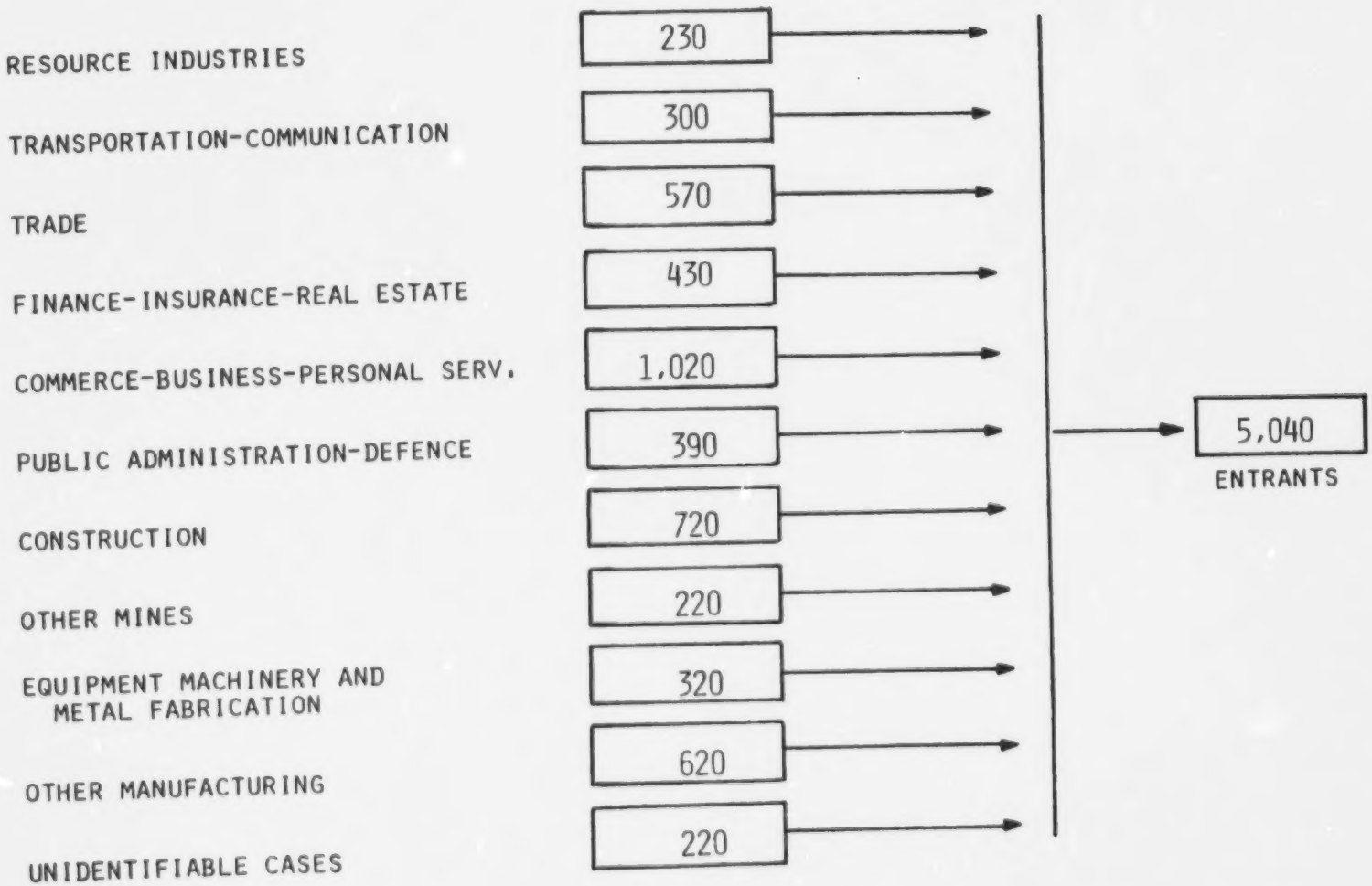


INTER-INDUSTRY MOBILITY - ENTRANTS (1980)

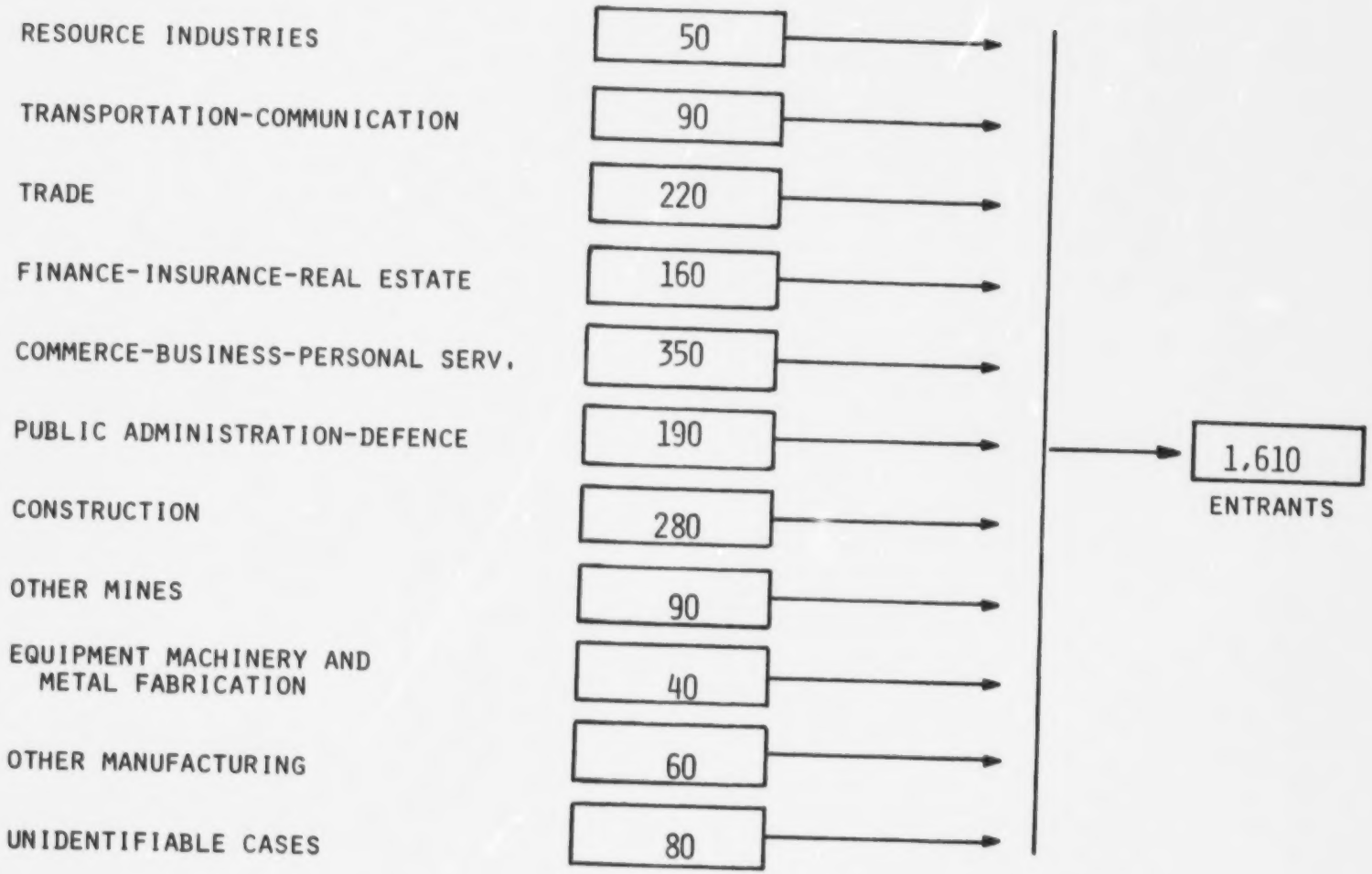
METAL MINING INDUSTRY (PRAIRIES)



INTER-INDUSTRY MOBILITY - ENTRANTS (1980)
METAL MINING INDUSTRY (BRITISH COLUMBIA)



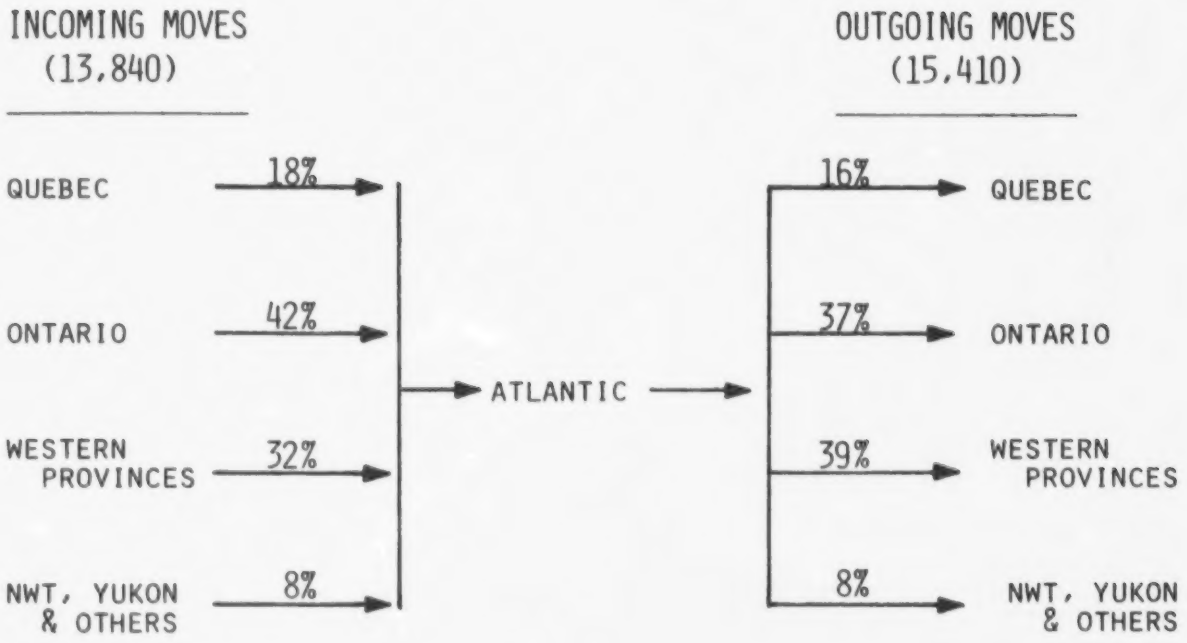
INTER-INDUSTRY MOBILITY - ENTRANTS (1980)
METAL MINING INDUSTRY (NORTHWEST TERRITORIES AND YUKON)



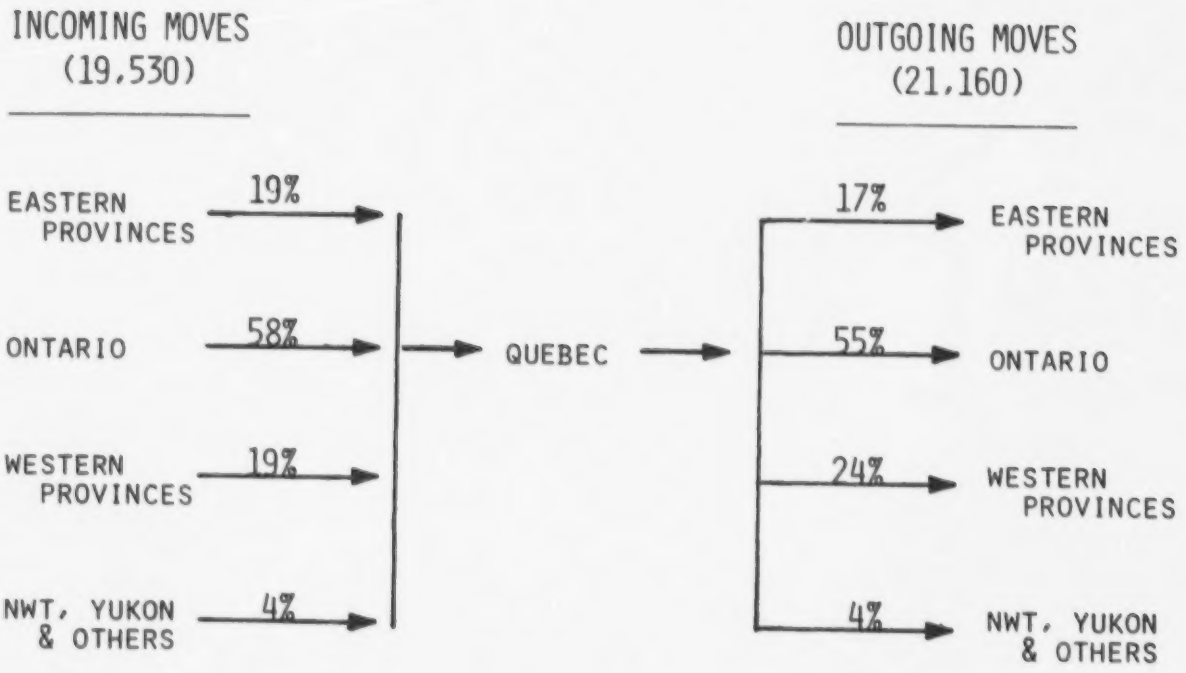
APPENDIX C

INTER-PROVINCIAL MOBILITY METAL MINING WORKERS

INTER-PROVINCIAL MOBILITY
METAL MINING INDUSTRY



INTER-PROVINCIAL MOBILITY
METAL MINING INDUSTRY



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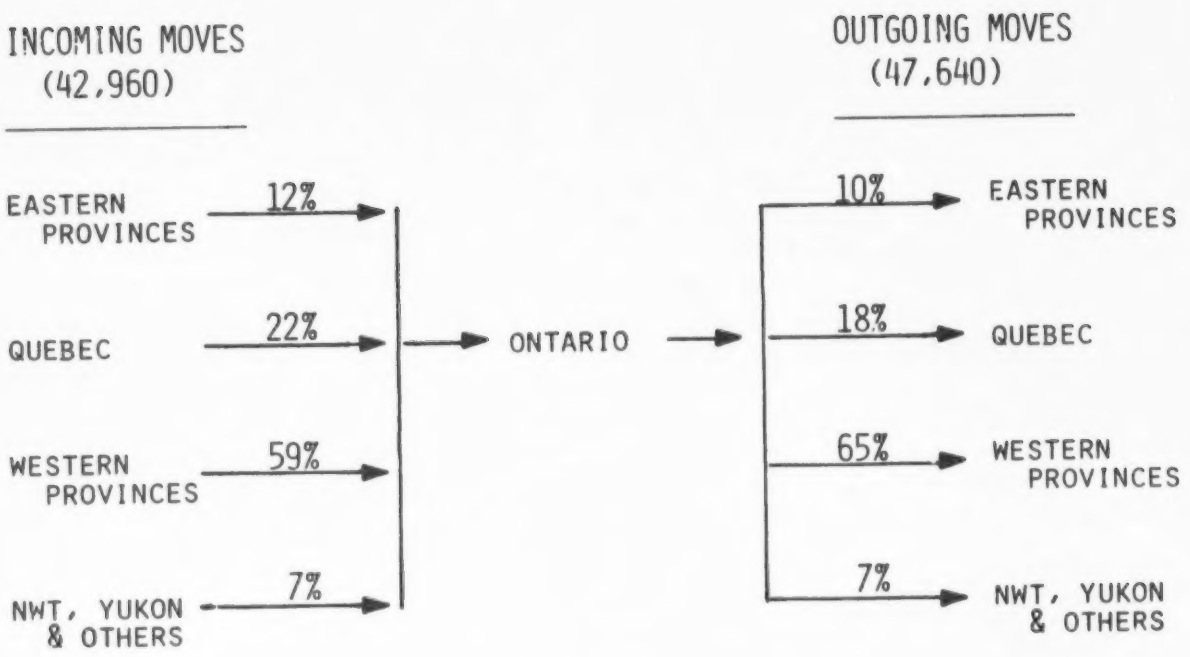
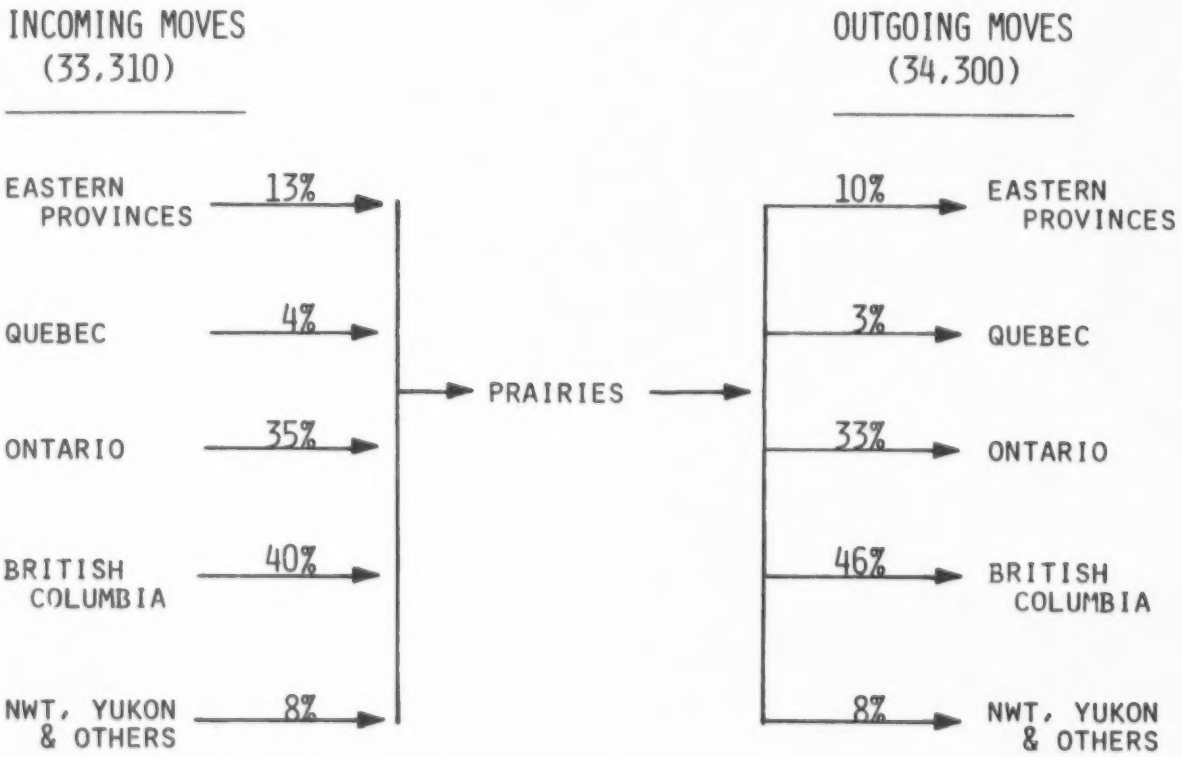
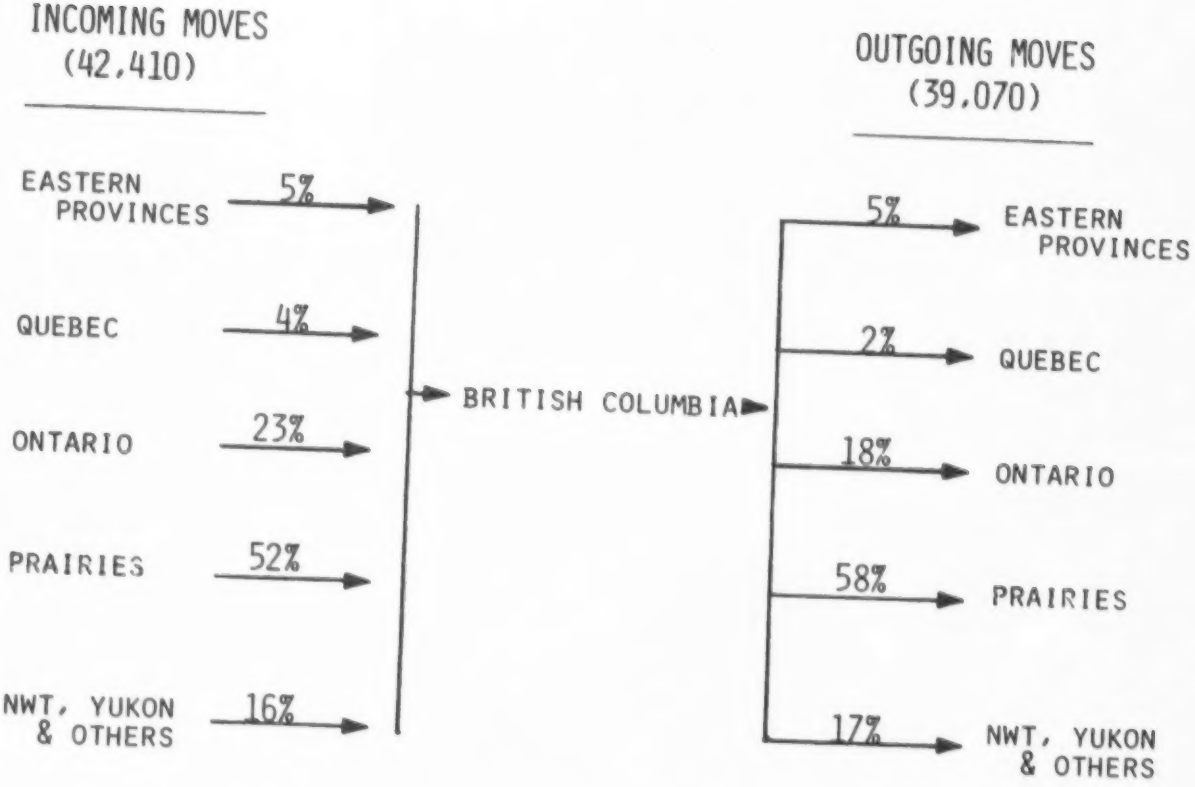
METAL MINING INDUSTRY



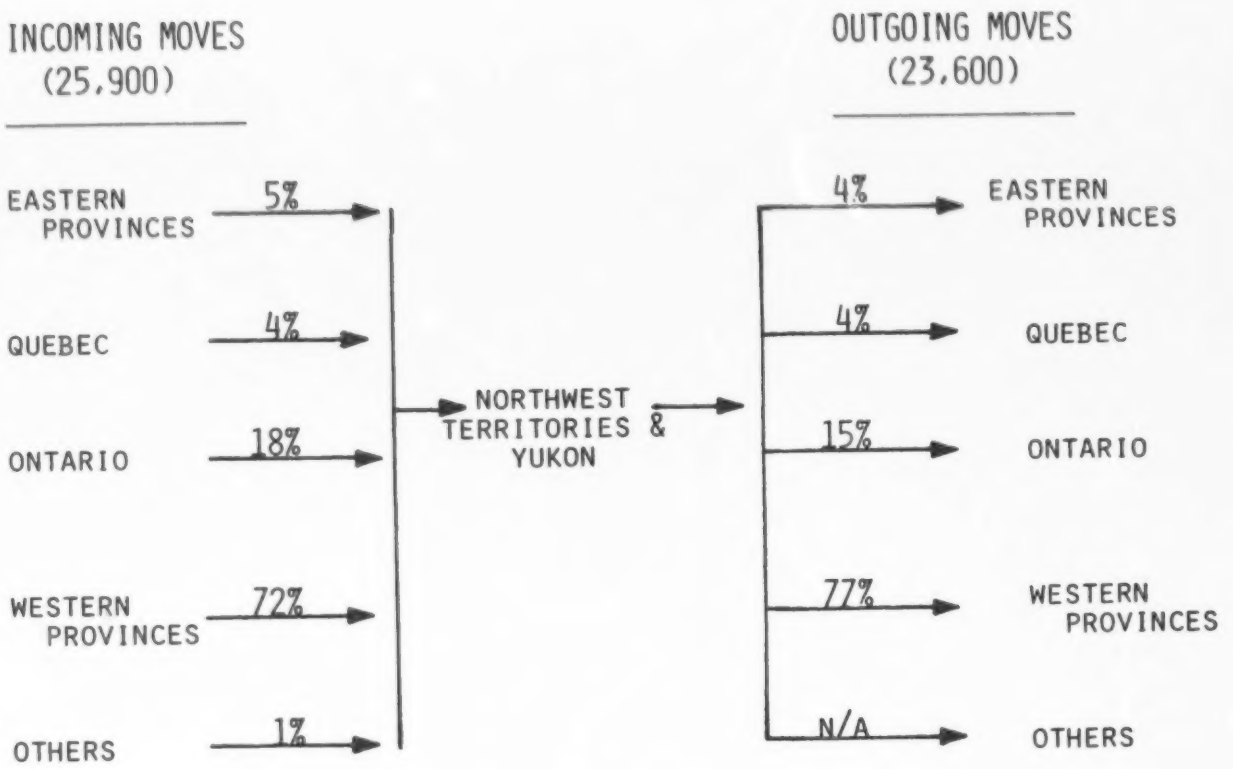
INTER-PROVINCIAL MOBILITY
METAL MINING INDUSTRY



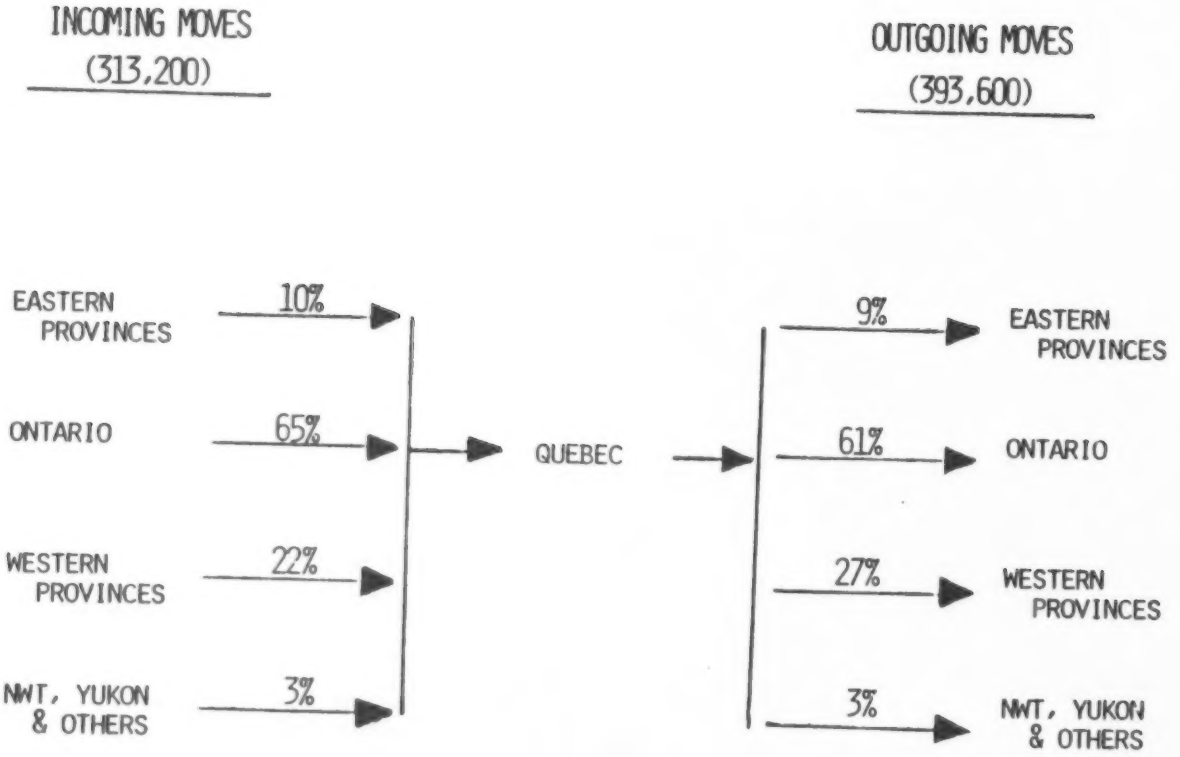
INTER-PROVINCIAL MOBILITY
METAL MINING INDUSTRY



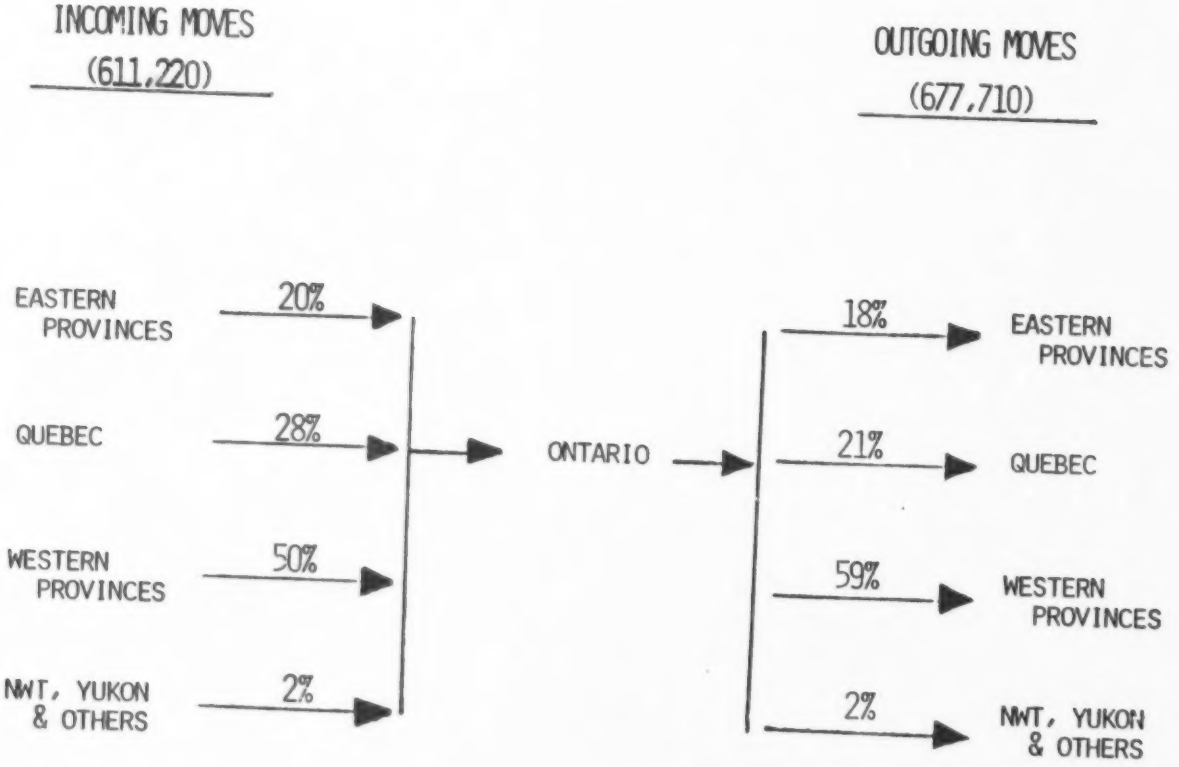
INTER-PROVINCIAL MOBILITY
METAL MINING INDUSTRY



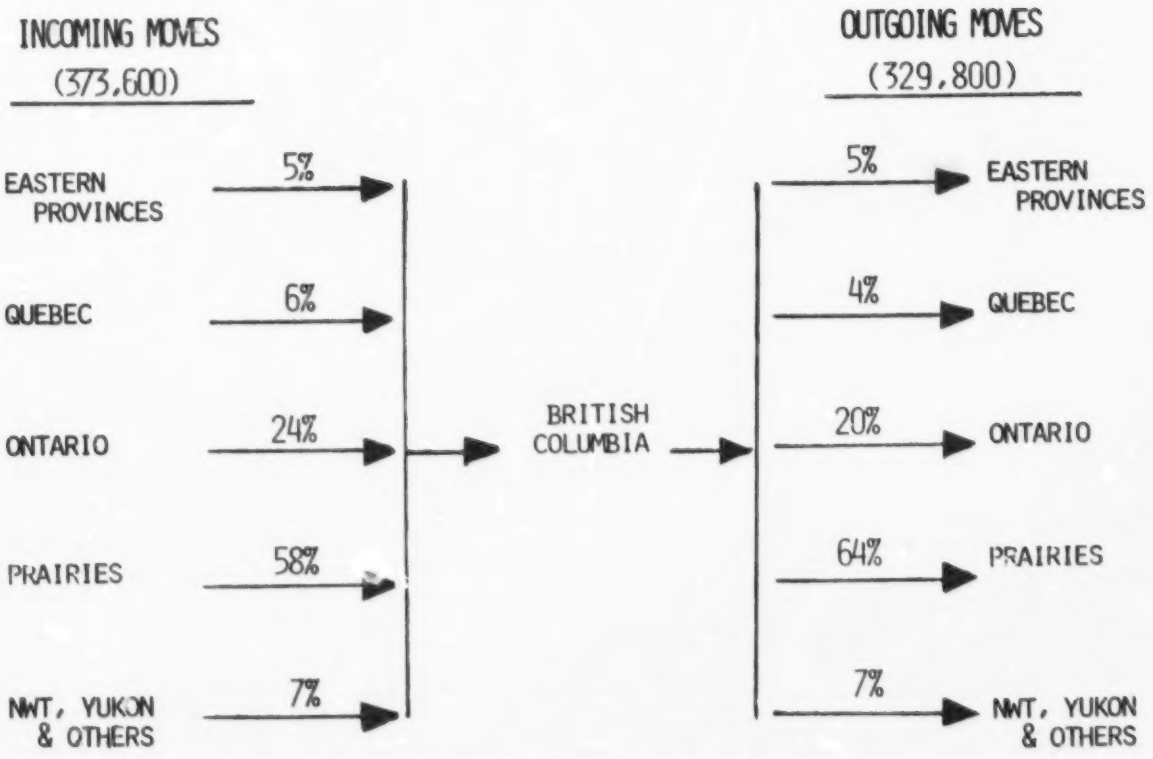
INTER-PROVINCIAL MOBILITY
MANUFACTURING SECTOR WORKERS



INTER-PROVINCIAL MOBILITY
MANUFACTURING SECTOR WORKERS



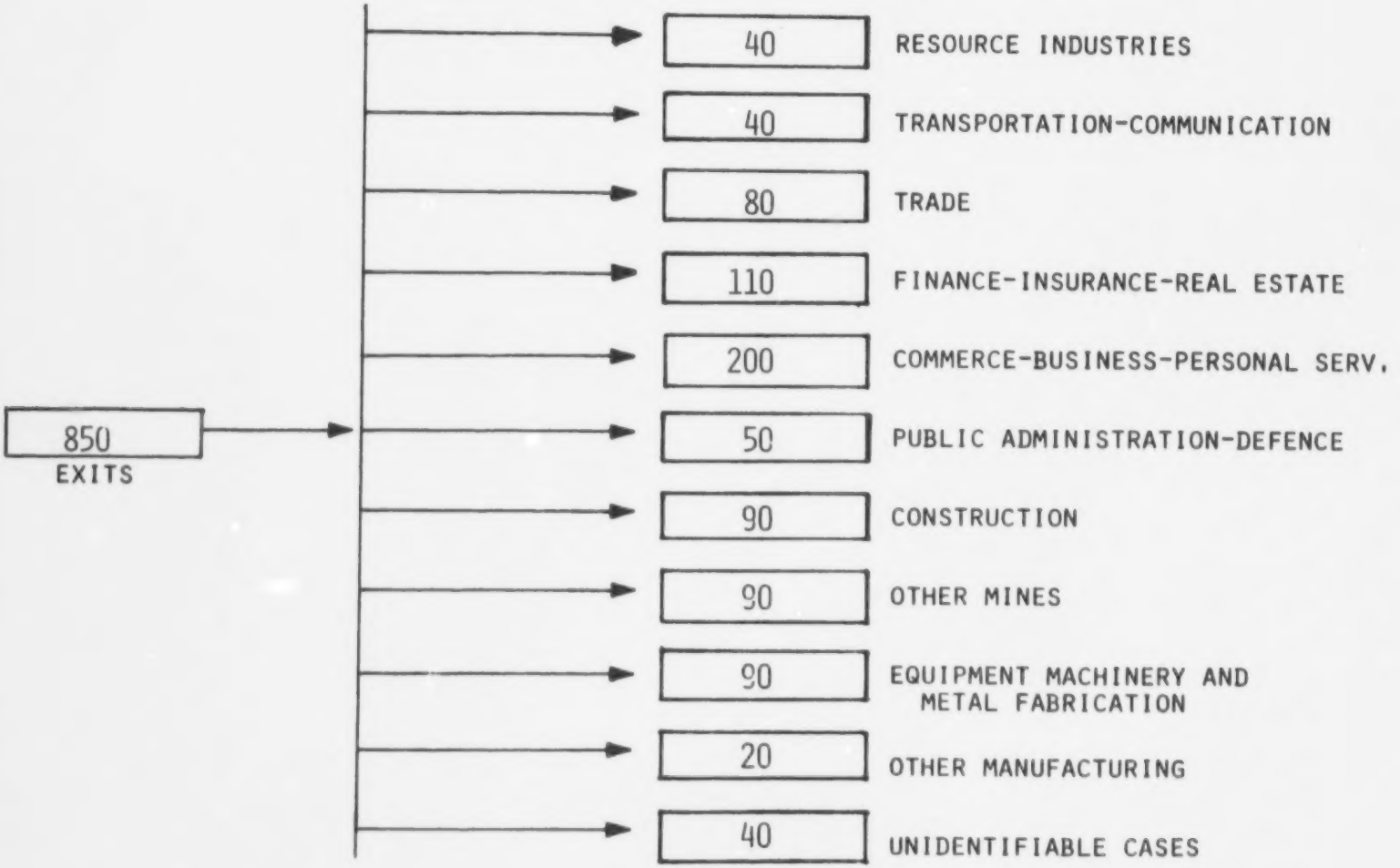
INTER-PROVINCIAL MOBILITY
MANUFACTURING SECTOR WORKERS



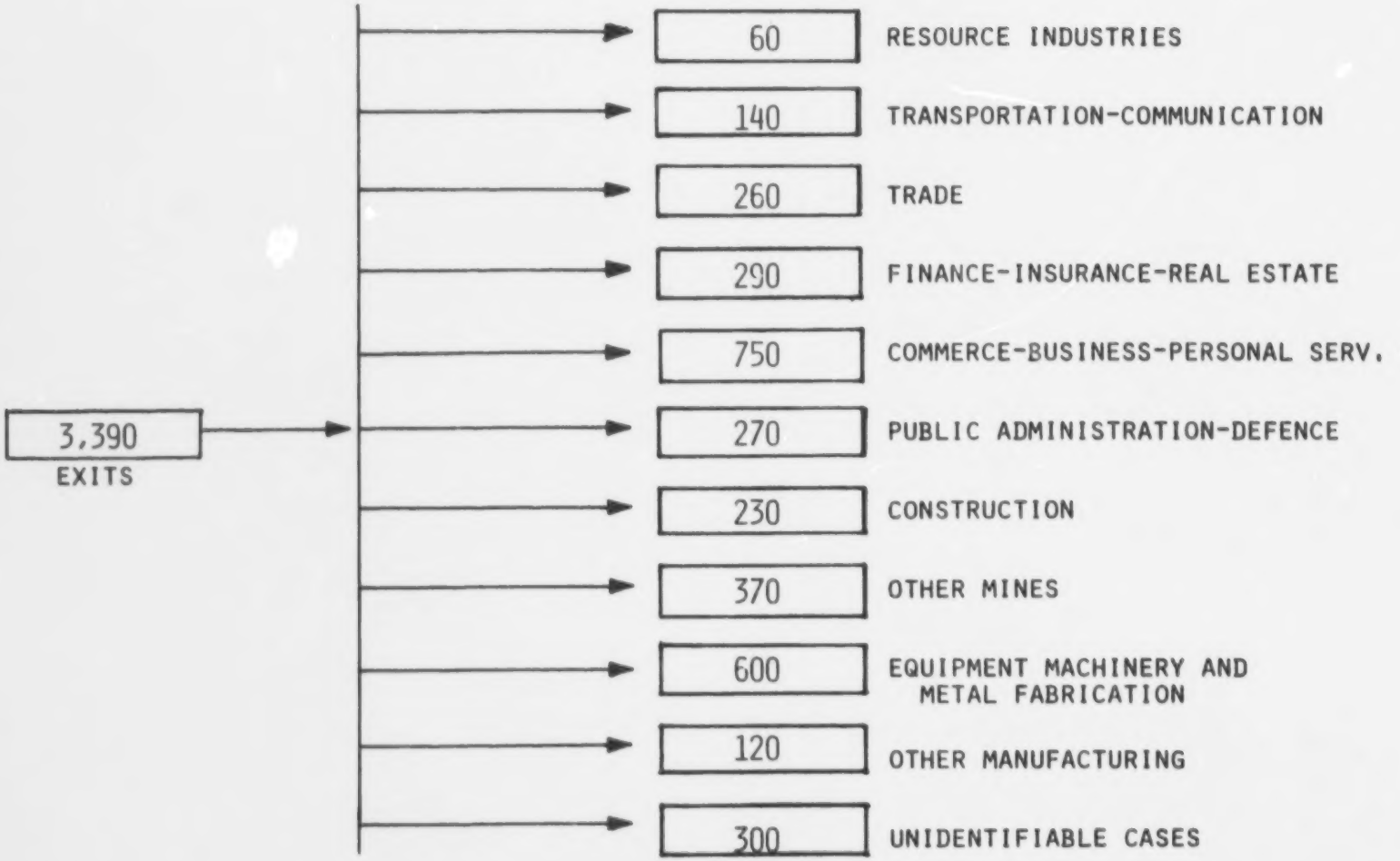
APPENDIX D

INTER-INDUSTRY MOBILITY - EXITS (1981)

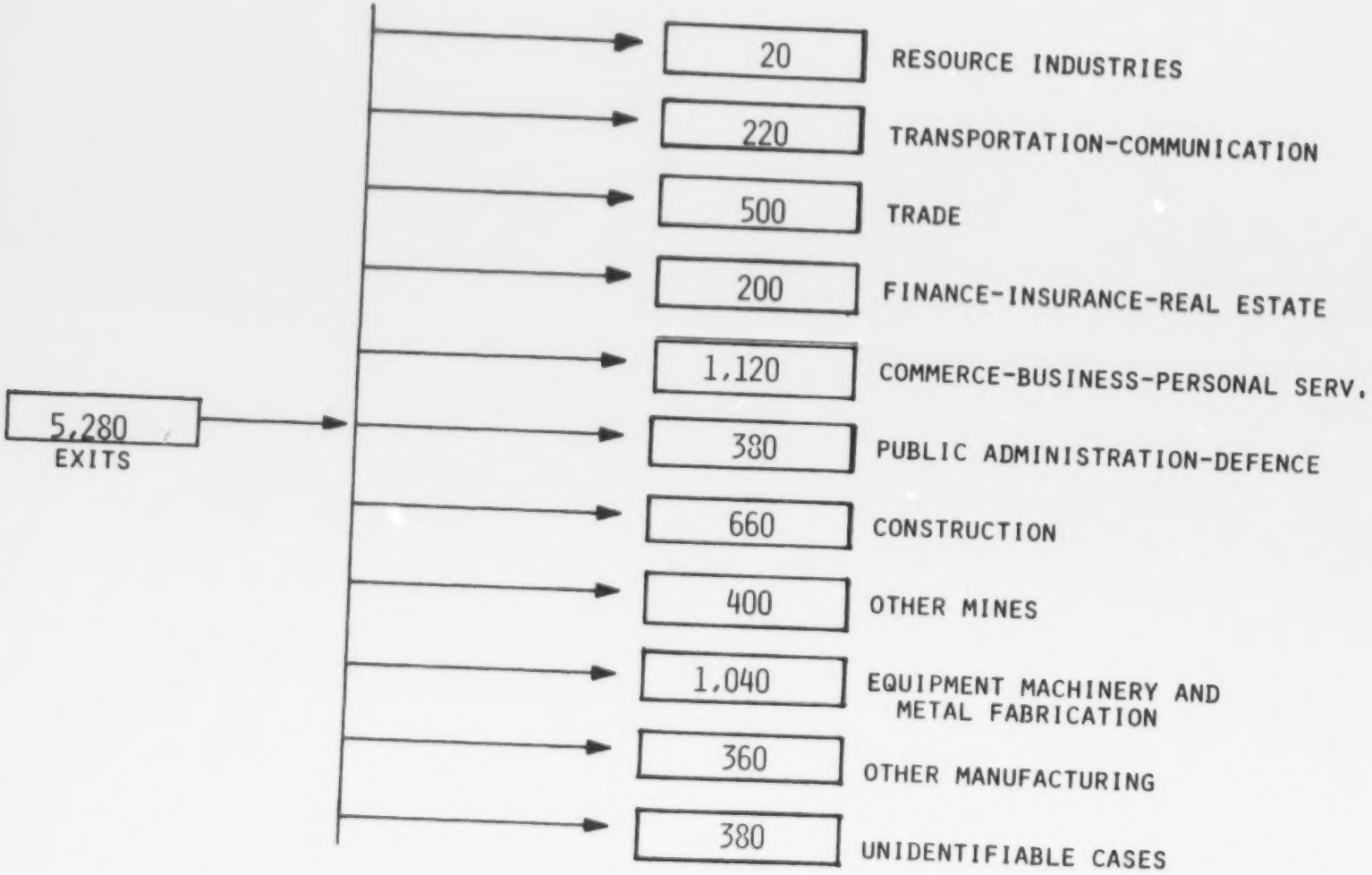
INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (ATLANTIC)



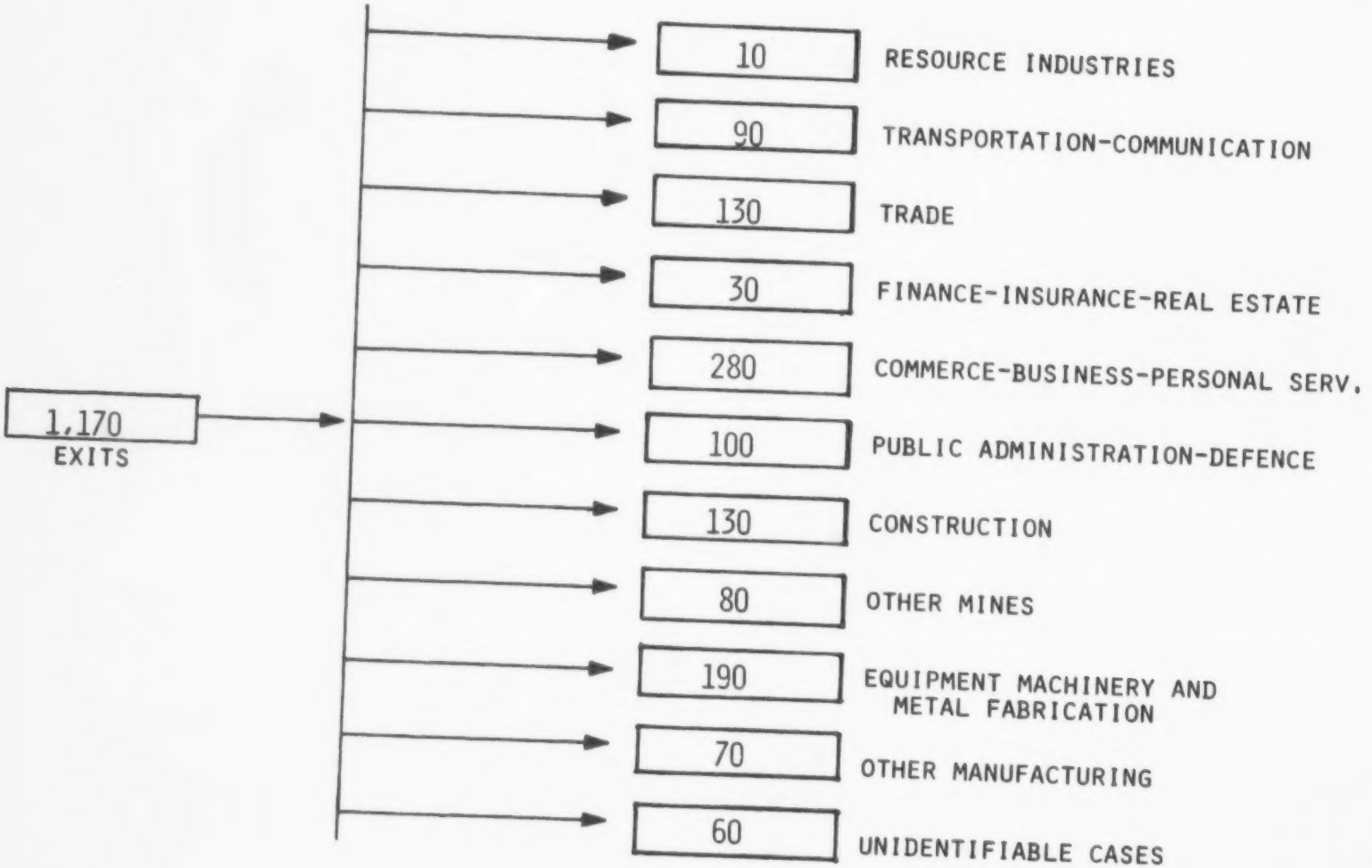
INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (QUEBEC)



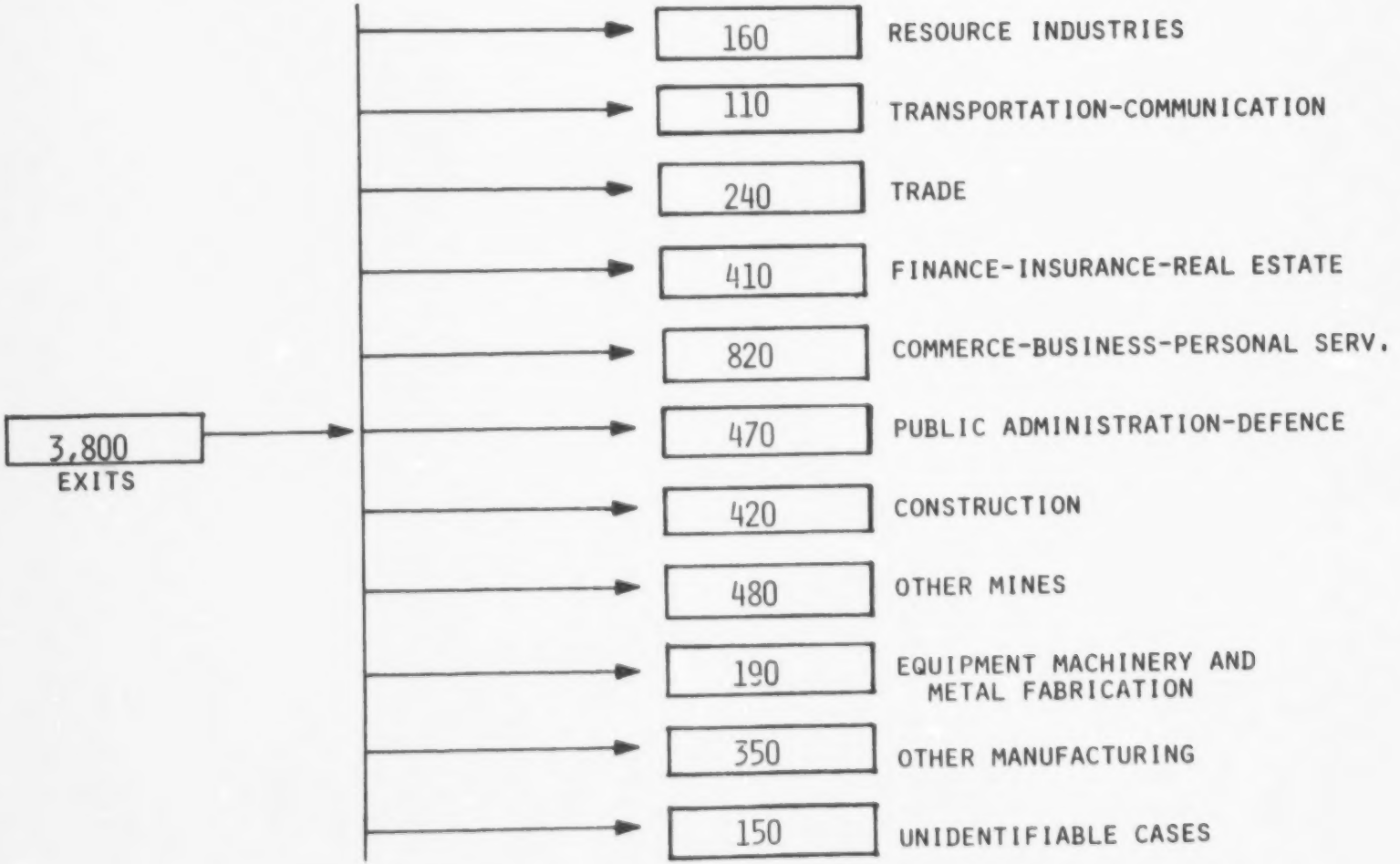
INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (ONTARIO)



INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (PRAIRIES)



INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (BRITISH COLUMBIA)



INTER-INDUSTRY MOBILITY - EXITS (1981)
METAL MINING INDUSTRY (NORTHWEST TERRITORIES AND YUKON)